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NATIONAL DAM SAFETY PROGRAM. DEER PARK POND DAM (NJ00502), DELA--ETC(U)
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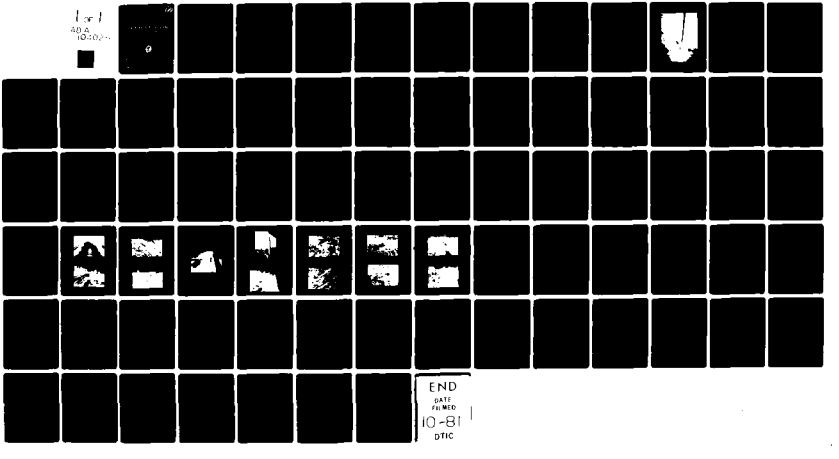

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DELAWARE RIVER BASIN,
TRIBUTARY TO MUSCONETCONG RIVER,
WARREN COUNTY,
NEW JERSEY.

DEER PARK POND DAM

NJ 00502

AD A104028

PHASE I INSPECTION REPORT.
NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

REPT. NO. DAEN/NAP-53842/NJ00502-81/08

AUGUST 1981

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams
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Visual Inspection
Structural Analysis
National Dam Safety Program
Deer Park Pond Dam, NJ
Spillways
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Seepage

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-N

31 AUG 1981

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Deer Park Pond Dam in Warren County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Deer Park Pond Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in poor overall condition. The dam's spillway is considered inadequate because a flow equivalent to 26 percent of the Spillway Design Flood - SDF - would cause the dam to be overtopped. (The SDF, in this instance, is one half of the Probable Maximum Flood). To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within three months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report the owner should engage a qualified professional consultant to perform the following:

(1) Design and oversee procedures for the removal of trees and their root systems from the downstream slope and for a distance of 25 feet from the downstream toe of the dam or to the limits of the owner's property.

(2) Design and oversee the installation of erosion protection for the upstream slope of the dam.

(3) Design and oversee repairs for the eroded area on the downstream slope to the left of the spillway.

(4) Investigate the reasons for the uneven surface of the dam crest, including the depressions to the right and left of the spillway and design remedial measures as needed.

(5) Investigate the seepage and ponding of water at and downstream of the toe of the dam and design remedial measures as required.

(6) Design and oversee repairs to the spillway aprons.

(7) Design and oversee repairs to the service bridge steel beam and supports.

c. Within three months from the date of approval of this report the following remedial actions should be initiated:

(1) Clear fallen trees from the spillway discharge channel and maintain the channel free of debris.

(2) Start a program of checking the condition of the dam periodically.

(3) Establish grass vegetation on the embankment and start a program for maintaining the embankment free of weeds, brush and trees.

(4) Clear trees, brush and debris from the discharge channel and from a zone 25 ft. wide on either side of the discharge channel for a distance of 100 ft. downstream from the end of spillway apron or to the property line whichever is the lesser.

d. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam, within one year from the date of approval of this report.

e. An emergency action plan and warning system should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Courter of the Thirteenth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

NAPEN-N
Honorable Brendan T. Byrne

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

DEER PARK POND DAM (NJ00502)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 23 April 1981 by Anderson-Nichols and Co. Inc., under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Deer Park Pond Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in poor overall condition. The dam's spillway is considered inadequate because a flow equivalent to 26 percent of the Spillway Design Flood - SDF - would cause the dam to be overtopped. (The SDF, in this instance, is one half of the Probable Maximum Flood). To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within three months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report the owner should engage a qualified professional consultant to perform the following:

(1) Design and oversee procedures for the removal of trees and their root systems from the downstream slope and for a distance of 25 feet from the downstream toe of the dam or to the limits of the owner's property.

(2) Design and oversee the installation of erosion protection for the upstream slope of the dam.

(3) Design and oversee repairs for the eroded area on the downstream slope to the left of the spillway.

(4) Investigate the reasons for the uneven surface of the dam crest, including the depressions to the right and left of the spillway and design remedial measures as needed.

(5) Investigate the seepage and ponding of water at and downstream of the toe of the dam and design remedial measures as required.

(6) Design and oversee repairs to the spillway aprons.

(7) Design and oversee repairs to the service bridge steel beam and supports.

c. Within three months from the date of approval of this report the following remedial actions should be initiated:

(1) Clear fallen trees from the spillway discharge channel and maintain the channel free of debris.

(2) Start a program of checking the condition of the dam periodically.

(3) Establish grass vegetation on the embankment and start a program for maintaining the embankment free of weeds, brush and trees.

(4) Clear trees, brush and debris from the discharge channel and from a zone 25 ft. wide on either side of the discharge channel for a distance of 100 ft. downstream from the end of spillway apron or to the property line whichever is the lesser.

d. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam, within one year from the date of approval of this report.

e. An emergency action plan and warning system should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

APPROVED: Roger Baldwin

ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

DATE: 31 Aug 81

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Deer Park Pond Dam
Identification No.:	Fed ID No. NJ00502
State Located:	New Jersey
County Located:	Warren
Stream:	Tributary of Musconetcong River
River Basin:	Delaware
Date of Inspection	April 23, 1981

ASSESSMENT OF GENERAL CONDITIONS

Deer Park Pond Dam is probably about 100 years old and is in poor condition. It is an earth embankment 410 feet long with a concrete and stone masonry spillway. The low-level outlets consist of two 12-inch cast iron pipes 15 feet apart that run under this spillway. The dam has a hydraulic height of 16.4 feet and a crest width ranging from 15 to 20 feet. An access road, along the full length of the dam, spans the spillway with a low, concrete-slab bridge. The dam is small in size and its hazard classification is significant. Trees are growing on the downstream slope and in the area downstream of the toe. A 2.5 foot diameter tree is growing on the right spillway training wall just downstream from the crest of the spillway. Wet, soft areas, standing pools of water, and seepage along the downstream toe and beyond are indicative of seepage through and under the dam. The dam crest is uneven and several large depressions on the upstream crest could be indicative of internal erosion of the embankment. Extensive erosion has taken place on the upstream slope at and above the waterline. An erosion path from crest to the downstream toe along the left side of the spillway is susceptible to further erosion from rainfall runoff or overtopping damage, should overtopping occur. Overflow at the spillway disappears about half way down the placed stone apron and reappears from under the apron at the downstream toe. The upstream spillway apron has two transverse cracks in the concrete. The spillway has a capacity of 114 cfs, which is sufficient to handle a storm 25% the size of the one-half PMF spillway design flood. Thus the spillway is considered inadequate.

The owner should engage a professional engineer qualified in the design and construction of dams to accomplish the following in the time periods specified. In the near future: design and oversee procedures for the removal of trees and their root systems from the downstream slope for a distance of 25 feet from the downstream toe or to the property line, whichever is less; design and oversee the installation of erosion protection

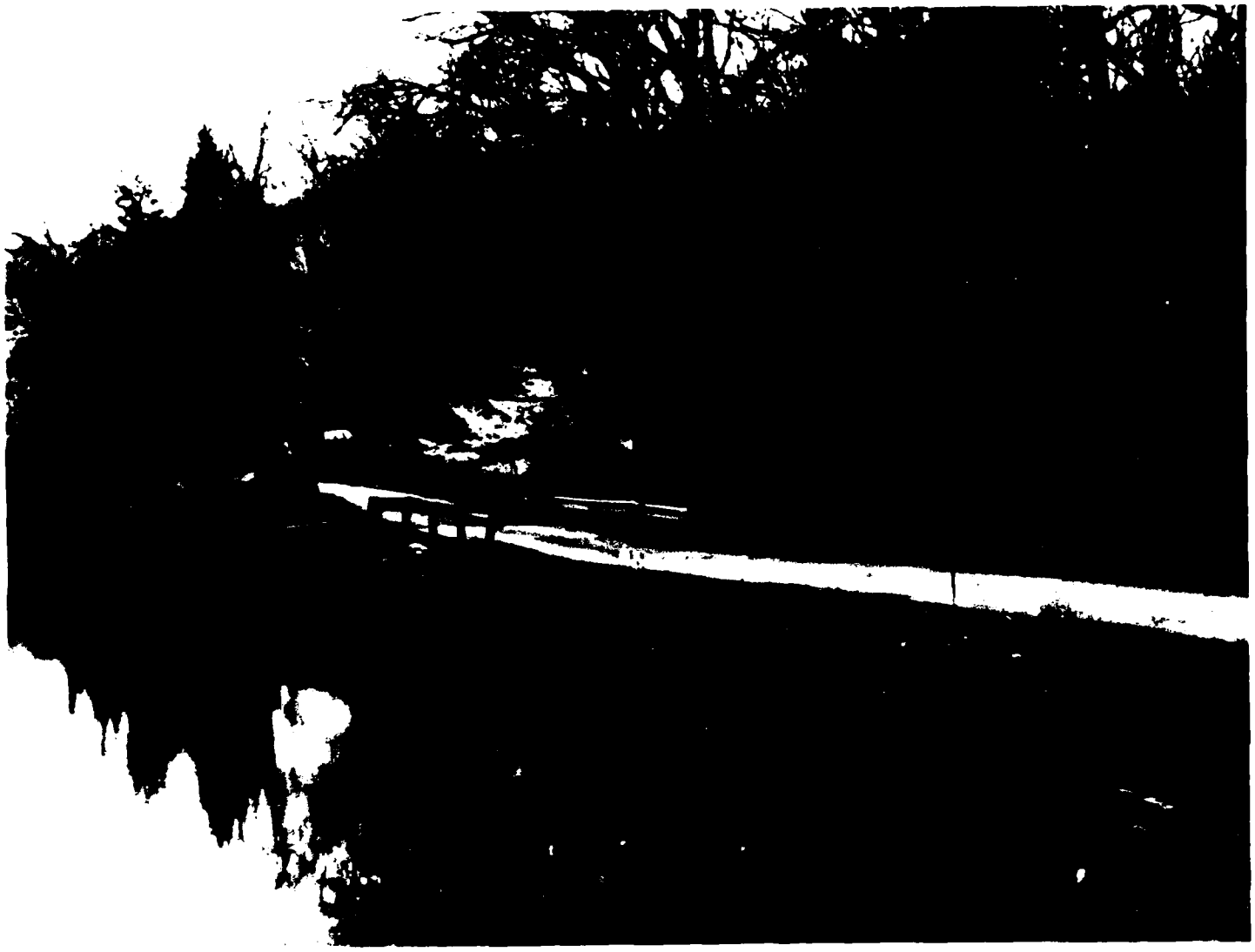
for the upstream slope of the dam; design and oversee repairs for the eroded area on the downstream slope to the left of the spillway; investigate the reasons for the uneven surface of the dam crest, including the depressions to the right and left of the spillway and design remedial measures as needed; investigate the seepage and ponding of water at and downstream of the toe of the dam and design remedial measures as required; design and oversee repairs to the spillway aprons; and design and oversee repairs to the service bridge steel beams and supports. In the future: perform a more detailed hydrologic/hydraulic evaluation of the inadequacy of the spillway and design and implement necessary remedial measures.

It is further recommended that the owner accomplish the following tasks as part of operational and maintenance procedures. Beginning soon: clear fallen trees from the spillway discharge channel and maintain the channel free of debris; check the condition of the dam periodically; establish grassy vegetation on the embankment and start a program for maintaining the embankment free of weeds, brush, and trees; and clear trees and brush for about 25 feet downstream from the toe of the dam and from the banks of the discharge channel for a distance of 100 feet downstream from the spillway or to the property line whichever is less. In the near future: develop an emergency action plan which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam. In the future: develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

ANDERSON-NICHOLS & COMPANY, INC.

Warren A. Guinan

Warren A. Guinan, P.E.
Project Manager
New Jersey 16848



April 22, 1981

DEER PARK DAM

OVERVIEW PHOTO

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonable possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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DEER PARK POND DAM SAFETY REPORT

DEER PARK POND DAM FED ID NO. NJ00502

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION PROGRAM
DEER PARK POND DAM
FED ID NO. #NJ00502

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Authority to perform the Phase I Safety Inspection of Deer Park Pond Dam was received from the State of New Jersey, Department of Environmental Protection, Division of Water Resources by letter dated 12 December 1980 under Basic Contract No. FPM-39 and Contract No. A01093 dated 10 October 1979. This Authority was given pursuant to the National Dam Inspection Act, Public Law 92-367 and by agreement between the State and the U.S. Army Engineers District, Philadelphia. The inspection discussed herein was performed by Anderson-Nichols & Company, Inc.

b. Purpose: The purpose of the Phase I Investigation is to develop an assessment of the general conditions with respect to the safety of Deer Park Pond Dam and appurtenances. Conclusions are based upon available data and visual inspection. The results of this study were used to determine any need for emergency measures and to conclude if additional studies, investigations, and analyses are necessary and warranted.

1.2 Project Description

a. Description of Dam and Appurtenances. Deer Park Pond Dam is a 410-foot long earthfill dam with concrete and stone masonry spillway. The dam has a hydraulic height of 16.4 feet and a structural height of 17.4 feet. The width of the dam crest ranges from 15 to 20 feet. The roadway, which runs along the crest of the dam, has standard highway guardrails on both sides at the spillway. Over the spillway is a concrete slab bridge; the concrete poured over timber decking. The spillway approach is a sloping concrete apron, the weir is an irregular, cut stone surface and the downstream face of the spillway is granite masonry. The spillway weir is 19.5 feet long and 12 feet wide. Both the spillway and the dam have an upstream slope of 4H:1V and a 2H:1V downstream slope. The upstream dam face shows significant sloughing. The downstream face is brush covered, exhibits sloughing and displacement of riprap. Trees are growing on the downstream face and at the toe.

b. Location. Deer Park Pond Dam is located on a tributary of the Musconetcong River, in Allamuchy Township, Warren County, New Jersey. The dam is at 40° 54.3' north latitude 74° 47.5' west longitude on the Tranquility, New Jersey Quadrangle. The dam may be reached by driving south on State Route 517 about 1.25 miles from the Allamuchy Exit on Interstate 80 and turning left on an unimproved road. The corner has a sign showing to "Deer Park Pond." The dam is about 1-1/2 miles eastward on this rough, winding road. A location map has been included as Figure 2.

c. Size Classification. Deer Park Pond Dam is classified as being small in size on the basis of storage at the dam crest of 456 acre-feet, which is less than 1000 acre-feet, but more than 50 acre-feet, and on the basis of its height of 17.4 feet, which is less than 40 feet, in accordance with criteria given in the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. Waterloo Road is approximately 3200 feet downstream of Deer Park Pond Dam. The road passes over the stream on a small, open span bridge. Approximately 500 feet downstream of the bridge, the stream flows into Saxton Lake on the Musconetcong River. At this juncture, there is a seasonal cabin, whose elevation is within a few feet of the water surface. Dam failure flood flows would overtop and severely damage the bridge and cause extensive damage to the cabin. If the cabin were occupied at the time of the dam failure, there is potential for the loss of a few lives. For these reasons Deer Park Pond Dam should be classified significant hazard.

e. Ownership. The dam is part of Allamuchy Mountain State Park, and is owned by the State of New Jersey. For information, Nick Domico, Park Manager, may be contacted at (201) 398-7010.

f. Purpose. Deer Park Pond Dam was built for fishing and other recreational uses.

g. Design and Construction History. The dam was designed and constructed by the New Jersey Bureau of Parks and Recreation. No other information was obtained.

h. Normal Operational Procedure. No operational procedures were found for the dam.

i. Site Geology. No site specific geologic information (such as borings) was available at the time the dam was inspected. Information derived from the Geologic Map of New Jersey (Kummel and Johnson, 1912) and the Glacial Drift of New Jersey (Salisbury, Kummel, Peet and Whitson, 1902) indicates soils within the immediate site consist of ground till overlying bedrock. The previously mentioned map indicates that bedrock in that area consists of granitoid gneiss of Precambrian age.

1.3 Pertinent Data

a. Drainage Area

.82 square miles

b. Discharge at Damsite (cfs)

Maximum flood at damsite - unknown.

Total ungated spillway capacity at maximum pool (top of dam) elevation - 114

c. Elevation (ft. above NGVD)

Top of dam - 936.4

Design surcharge (1/2 PMF) - 937.7

Recreation pool (at time of inspection) - 935.0

Spillway crest - 934.6

Streambed at centerline of principal spillway - 920.0

Maximum tailwater - 925 (estimated)

d. Reservoir (Length in feet)

Maximum pool - 1900 (estimated)

Spillway crest - 1800 (estimated)

e. Storage (acre-feet)

Spillway crest - 356.0

Top of dam - 455.8

Test flood - 538.0

f. Reservoir Surface (acres)

Top of dam - 60

Spillway crest - 51

g. Dam

Type - earthfill

Length - 410 feet

Height - 16.4 feet (hydraulic)

- 17.4 feet (structural)

Top width - 15 to 20 feet (varies)

Side slopes - upstream 4H:1V; downstream 2H:1V

Zoning - unknown

Impervious core - unknown

Cutoff - unknown

Grout curtain - unknown

h. Spillway

Type - Broad crested concrete spillway (concrete upstream apron, sloped 4H:1; placed cutstone downstream face on slope of 2H:1V)

Length of weir - 19.5 feet

Crest elevation - 934.6 feet NGVD

Low level outlet - See Item i below

U/S channel - Deer Park Pond

D/S channel - Unnamed tributary of Musconetcong River

i. Regulating Outlets

Type - Two 12-inch pipes

Length - 117 feet (estimated)
Upstream inlets not seen, pipes are 15 feet center to center

Access - each is about 2 feet centerward from spillway training walls.

Invert Elevations: 920 and 921.7 (Downstream)

SECTION 2
ENGINEERING DATA

2.1 Design

No hydraulic, hydrologic, or other design engineering data were disclosed.

2.2 Construction

No recorded data concerning construction of the Deer Park Pond Dam were discovered.

2.3 Operation

No data pertaining to the operation of the dam were found.

2.4 Evaluation

a. Availability. A search of the New Jersey Department of Environmental Protection files, and contact with community officials revealed no information.

b. Adequacy. The visual inspection is deemed adequate to complete this Phase I Inspection Report.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. Dam. Trees are growing on the downstream slope and in the area at the downstream toe of the dam. In addition, many areas on the downstream slope are covered with dumped riprap. Extensive erosion has taken place on the upstream slope at and above the waterline.

Two major depressions were observed to the right of the spillway bridge at the crest of the upstream slope. The depressions were approximately 3 to 5 feet in diameter and approximately 1-foot deep. Similarly several depressions and holes were observed on the crest of the dam to the left of the spillway bridge.

The crest of the dam is rather uneven and is mostly bare of grass and vegetation due to pedestrian and vehicular traffic across the dam.

An erosion gully has developed on the downstream slope on either side of the spillway service bridge.

A zone of standing water, approximately 50 feet wide, was observed at the toe of the dam to the left of the spillway. Slight seepage was observed which was clear and showed no evidence of suspended fines. In addition, seepage was noted flowing from the left bank of the discharge channel just downstream from the spillway. The seepage contained some orange colored flocs with no evidence of suspended fines. The area downstream of the downstream toe of the dam is generally wet and soft and several ponds of standing water were observed.

b. Appurtenant Structures

A 2.5-foot diameter tree is growing on the right spillway training wall just downstream from the crest of the spillway. Reservoir-bottom vegetation is partially blocking the entrance to the spillway. Considerable water was observed exiting underneath the spillway apron at the toe of the slope.

(1) Ungated Spillway. The upstream concrete apron has two transverse cracks and the concrete training wall on the right side has separated approximately 1/2 inch from the bridge pier. Minor leakage was observed through the mortared masonry abutment wall approximately 2 feet below the crest.

(2) Service Bridge. The steel center supports are badly corroded at the bottom of each support providing very little support. Visible portions of bridge beams are badly rusted.

(3) Low-Level Outlet. Two 12-inch cast iron pipes were observed at the toe of the spillway. However, no valves or inlet structure was observed at the time of inspection.

c. Reservoir Area

The watershed above the lake is gently to moderately sloping. The reservoir slopes appear to be stable. No evidence of significant sedimentation was observed.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

No formal operating procedures were disclosed.

4.2 Maintenance of Dam

No formal maintenance procedures for the dam were found, but from its condition, it is apparent that maintenance is needed to prevent serious deterioration of the structure.

4.3 Maintenance of Operating Facility

No formal maintenance procedures for the operating facilities were disclosed.

4.4 Warning System

No description of any warning system was disclosed.

4.5 Evaluation of Operational Adequacy

Because of the lack of operation and maintenance procedures, the remedial measures described in Section 7.2 should be implemented as prescribed.

SECTION 5
HYDROLOGIC/HYDRAULIC

5.1 Evaluation of Features

a. Design Data. Because no hydrologic or hydraulic data were revealed an evaluation could not be performed.

b. Experience Data. No experience data were found.

c. Visual Observation. No valves or upstream inlets for the two 12-inch low-level outlets were visible. The inlets may have flap gates that are located off shore in the reservoir; neither pipe was leaking. The small discharge over the weir at the time of the inspection, was confined to the left side. The water disappeared in the placed stone of the downstream face and reappeared at the right center of the toe of the masonry apron. A small amount of bottom vegetation had accumulated in the mouth of the spillway and some had washed over the crest and was caught on the stone masonry on the right side of the apron.

d. Deer Pond Park Overtopping Potential. The hydraulic/hydrologic evaluation for the dam is based on a selected Spillway Design Flood (SDF) equal to one-half the Probable Maximum Flood (PMF) in accordance with the range of test floods given in the evaluation guidelines, for dams classified as Significant Hazard and small in size. The PMF was determined by application of a 24-hour Probable Maximum Precipitation (PMP) of 22.9 inches to the SCS dimensionless unit hydrograph for the area. Hydrologic computations are given in Appendices 3 and 4. The routed half-PMF peak inflow to the reservoir is 1957 cfs, the peak outflow is 1618 cfs.

The minimum elevation of the dam allows 1.8 feet of depth above the spillway, before overtopping occurs. Under this head the total spillway capacity is 114 cfs.

Flood routing calculations indicate that Deer Park Pond Dam will be overtopped for 6.4 hours to a maximum depth of 1.3 feet under half-PMF conditions. It is estimated that the spillway capacity is adequate to pass a storm 25% the size of the one half-PMF without overtopping the dam; thus, the spillway is considered inadequate.

e. Draw-down Capacity. Assuming the two low-level outlets currently in place are in operable condition, it is estimated that the lake can be drained in approximately 10 days assuming no significant inflow. This time period is considered marginally acceptable for draining the reservoir in an emergency situation.

SECTION 6
STRUCTURAL STABILITY

6.1 The presence of considerable dumped riprap makes it difficult to perform an adequate inspection of the downstream slope of the embankment.

Trees growing on the downstream slope of the embankment and in the area downstream of the toe may blow over and pull out their roots, or they may die and their roots rot. In either case, serious seepage and erosion problems could result.

The crest of the dam is uneven. Although the cause of the unevenness cannot be determined on the basis of the visual inspection alone, it may be a sign of potential stability problems. The presence of several large depressions on the upstream slope near the crest could be an indication of internal erosion of the embankment which, if not stopped, could lead to breaching of the dam.

The bare roadway along the crest of the dam is susceptible to erosion if the dam were overtopped, which might, in turn, lead to breaching of the dam.

The erosion path, from the crest to the downstream toe of the embankment to the left of the spillway is susceptible to erosion and consequent damage to the embankment owing to both runoff of rainfall and overtopping, if the latter should occur.

The soft, wet areas and seepage at and immediately downstream of the toe of the dam is indicative of seepage either through or under the dam which, if not properly controlled, could lead to failure of the dam by piping or sloughing of the downstream slope.

Based on the visual inspection alone, it is not possible to determine the character of the dam and spillway foundations, or the interior of the cross section of the embankment or the slope of the upstream side of the embankment. Therefore, it is not possible to evaluate the factor of safety of the dam and spillway against slope failure.

6.2 Design and Construction Data. No design or construction data pertinent to the structural stability of the dam are available.

6.3 Operating Records. No records pertinent to the structural stability of the dam were found.

6.4 Post-Construction Changes. No record of post-construction changes was available. However, the concrete in the upstream spillway training walls, apron, and bridge slab probably are rather recent additions.

6.5 Seismic Stability. This dam is in Seismic Zone 1. According to the Recommended Guidelines, dams located in Seismic Zone 1 "may be assumed to present no hazard from earthquake provided static stability conditions are satisfactory and conventional safety margins exist." The visual observations made during the inspection provided an indicator of unstable embankments as mentioned in Section 6.1. However, because no data are available concerning the engineering of the embankment and foundation materials for this dam or the condition at the base of the corewall, it is not possible to make an engineering evaluation of the stability of the slopes or the factor of safety under static conditions.

SECTION 7
ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. Deer Park Pond Dam is estimated to be about 100 years old and is in poor overall condition.

b. Adequacy of Information. The information available is such that the assessment of the dam must be based primarily on the results of the visual inspection.

c. Urgency. The recommendations made in 7.2.a and 7.2.b should be implemented by the owner as prescribed.

d. Necessity for Additional Data/Evaluation. The information available from the visual inspection is adequate to identity the potential problems which are listed in 7.2.a. These problems require the attention of a professional engineer who will have to make additional engineering studies to design or specify remedial measures to rectify the problems. If left unattended, the problems could lead to failure of the dam.

7.2 Recommendations/Remedial Measures

a. Recommendations. The owner should retain a professional engineer qualified in the design and construction of dams to accomplish the following items in the time periods specified:

In the near future:

(1) Design and oversee procedures for the removal of trees and their root systems from the downstream slope and for a distance of 25 feet from the downstream toe of the dam or to the limits of the owner's property.

(2) Design and oversee the installation of erosion protection for the upstream slope of the dam.

(3) Design and oversee repairs for the eroded area on the downstream slope to the left of the spillway.

(4) Investigate the reasons for the uneven surface of the dam crest, including the depressions to the right and left of the spillway and design remedial measures as needed.

(5) Investigate the seepage and ponding of water at and downstream of the toe of the dam and design remedial measures as required.

(6) Design and oversee repairs to the spillway aprons.

(7) Design and oversee repairs to the service bridge steel beam and supports.

In the future:

Perform a more detailed hydrologic/hydraulic evaluation of the inadequacy of the spillway and design and implement necessary increased capacity.

b. Alternatives. If dam is required for recreational use, no alternatives are recommended.

c. Operating and Maintenance Procedures

The owner should accomplish the following soon:

1. Clear fallen trees from the spillway discharge channel and maintain the channel free of debris.

2. Start a program of checking the condition of the dam periodically.

3. Establilsh grass vegetation on the embankment and start a program for maintaining the embankment free of weeds, brush and trees.

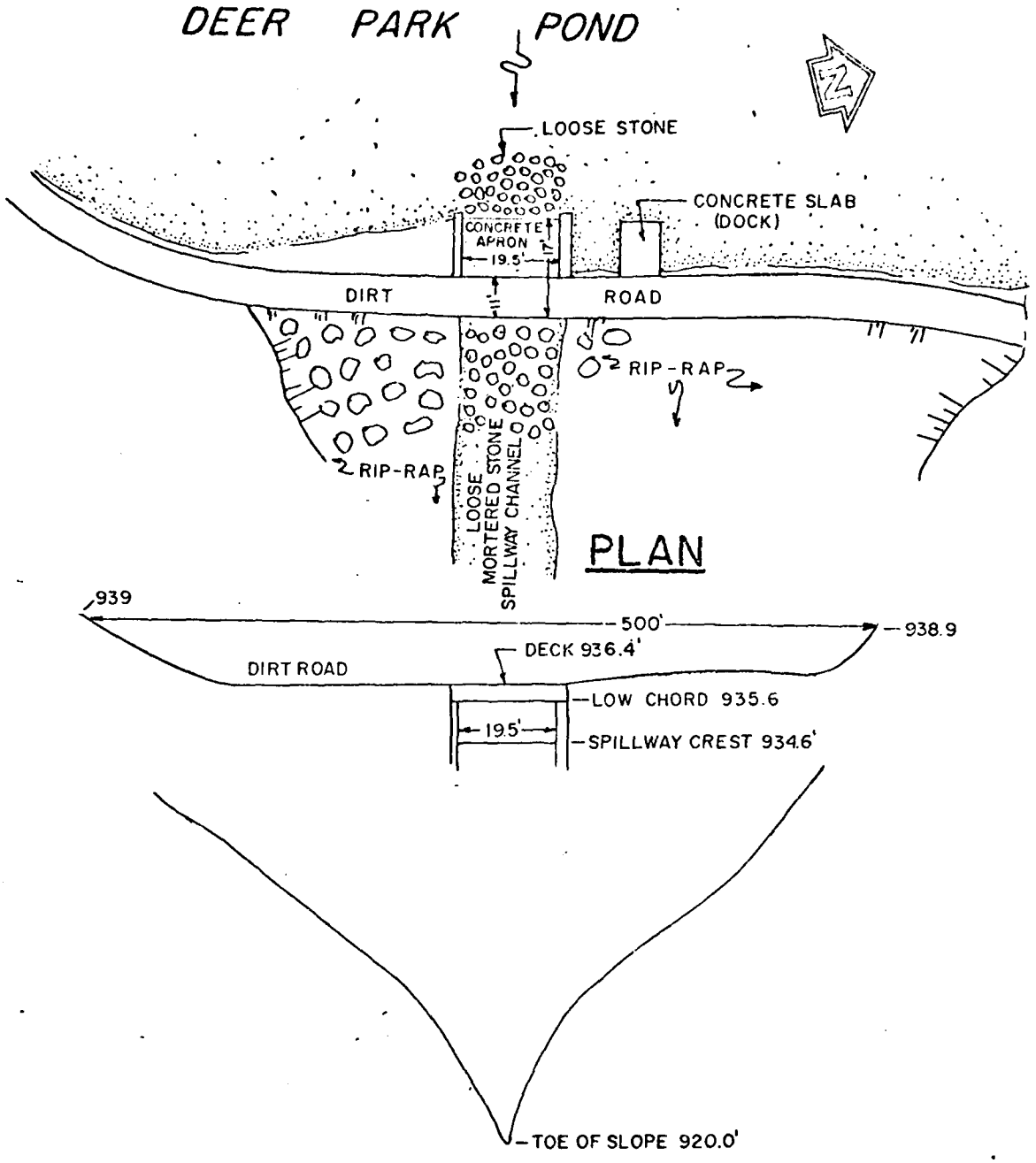
4. Clear trees, brush and debris from the discharge channel and from a zone 25 ft. wide on either side of the discharge channel for a distance of 100 ft. downstream from the end of spillway apron or to the property line whichever is the lesser.

The Owner should do the following in the near future:

Develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

The Owner should do the following in the future:

Develop an emergency action plan which outlines actions taken by the owner to minimize downstream effects of an emergency at the dam.



Anderson-Nichols & Co, Inc. BOSTON MASSACHUSETTS	U.S. ARMY ENGINEER DIST PHILADELPHIA CORPS OF ENGINEERS PHILADELPHIA, PA

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

DEER PARK POND DAM

TRIB. TO MUSCONETCONG RIVER NEW JERSEY

SCALE: NOT TO SCALE

DATE: JUNE 1981

FIGURE-1

SCALE IN MILES

0 4 8

MAP BASED ON STATE OF NEW JERSEY OFFICIAL MAP & GUIDE.

Anderson-Nichols & Co., Inc.
BOSTON MASSACHUSETTS

U.S. ARMY ENGINEER DIST. PHILADELPHIA
CORPS OF ENGINEERS
PHILADELPHIA, PA.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

DEER PARK POND DAM
LOCATION MAP

TRIB. TO MUSCONETCONG RIVER NEW JERSEY

SCALE: 1" = 4 Miles Approx.

DATE: JUNE 1981

APPENDIX 1

CHECK LIST

VISUAL INSPECTION

DEER PARK POND DAM

Check List
Visual Inspection
Phase 1

Name Dam Deer Park Pond County Warren State NJ (00502) Coordinators NJDEP

Date(s) Inspection 2/16/81, 4/22/81 Weather Sunny, Overcast Temperature 55°, 35°

Pool Elevation at Time of Inspection 934.7' NGVD Tailwater at Time of Inspection 920.5 NGVD

Inspection Personnel:

W. Guinan

S. Gilman

R. Murdock

D. Deane

K. Stuart

C. Plaud

S.Gilman/R.Murdock/C.Plaud Recorder

The owner was not present during inspection

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Significant sloughing on upstream face, sloughing and displacement of riprap on downstream face; trees on slope and at toe.	Remove trees on slope and at toe under proper supervision.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal - good. Vertical - undulation of surface.	
RIPRAP FAILURES	Vertical scarps along upstream face, riprap missing in many locations.	Repair riprap.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
RAILINGS	None	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Erosion on both sides of spillway on downstream slope.	Repair eroded areas and install erosion protection.
ANY NOTICEABLE SEEPAGE	Wet and soft along toe to left of spillway - large pool standing water noted adjacent to toe.	Investigate problem and correct.
STAFF GAGE AND RECORDER	None	
DRAINS	None	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	N/A	
INTAKE STRUCTURE	Not visible	
OUTLET PIPE	2 - 12-inch C.I.P. at base of spillway. No leakage noted. No gates visible at time of inspection.	
OUTLET CHANNEL	N/A	
EMERGENCY GATE	Not visible	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Weir crest is cut stone with irregular surface and numerous open joints between stone.	
APPROACH CHANNEL	Concrete apron 2-in - 4-in below crest. Sloping u/s surface has eroded. Two transverse cracks 1/4-in wide in concrete near left side. Concrete abutments - fair Right u/s concrete wing wall has separated from bridge. Pier approx. 1/2-inch. Channel itself, clear and unobstructed.	Repair cracks
DISCHARGE CHANNEL	Surface is grouted loose rock - 3-inch - 6-inch in size. Much of the mortar is cracked. Water overflowing spillway crest is flowing into mortared rock face and exiting at the bottom. A few of the rocks are missing. Abutment walls are mortared stone masonry walls. Tree on right side has roots growing out into spillway surface. A little leakage noted 2 ft below crest exiting from abutment wall. Channel has boulders, debris and some fallen trees.	Repair mortar and rock face. Remove tree and roots under proper supervision. Clear debris.
BRIDGE AND PIERS OVER SPILLWAY	Poured concrete over wood deck. Deck surface in good condition. Some spalling at each end of deck. Both abutments in fair condition. Center support angles are badly corroded at the bottom - providing very little support. Visible portions of steel beams are badly rusted. Galvanized metal bridge railing - good condition.	Investigate extent of corrosion and repair.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Very steep, rocky, fallen trees in channel; overbanks have large trees; no brush. Also see comments for spillway channel.	
SLOPES	Steep side slopes on channel.	
APPROXIMATE NO. OF HOMES AND POPULATION	One house on d/s left overbank at Waterloo Road crossing, approximately 4 feet above road elevation may be reached; stream is channelized u/s of Waterloo Road.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gradual to steeply sloped, wooded.	
SEDIMENTATION	No significant sedimentation observed.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	None found
REGIONAL VICINITY MAP	Prepared for this report
CONSTRUCTION HISTORY	None found
TYPICAL SECTIONS OF DAM	None found
HYDROLOGIC/HYDRAULIC DATA	None found
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	None found
RAINFALL/RESERVOIR RECORDS	None found

ITEM	REMARKS
DESIGN REPORTS	None found
GEOLOGY REPORTS	None found
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None found
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None found
POST-CONSTRUCTION SURVEYS OF DAM	None found
BORROW SOURCES	Unknown

ITEM	REMARKS
MONITORING SYSTEMS	None found
MODIFICATIONS	None found
HIGH POOL RECORDS	None found
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None found
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None found
MAINTENANCE OPERATION RECORDS	None found

ITEMS	REMARKS
SPILLWAY PLAN	
SECTIONS	None found
DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	None found

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: .82 square miles, woods, .01 square miles, wetlands

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 934.6' NGVD (356.0 acre feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY) Not applicable

ELEVATION MAXIMUM TEST FLOOD POOL: 937.7' NGVD

ELEVATION TOP DAM: 936.4' NGVD

SPILLWAY CREST: Uncontrolled stone

a. Elevation 934.6' NGVD

b. Type Irregular cut masonry

c. Width 12 feet

d. Length 19.5 feet

e. Location Spillover Center of dam

f. Number and Type of Gates None

OUTLET WORKS: Low level outlet

a. Type 2 12-inch pipes

b. Location Approximately 2 feet from either spillway wall Next to stilling basin on downstream side

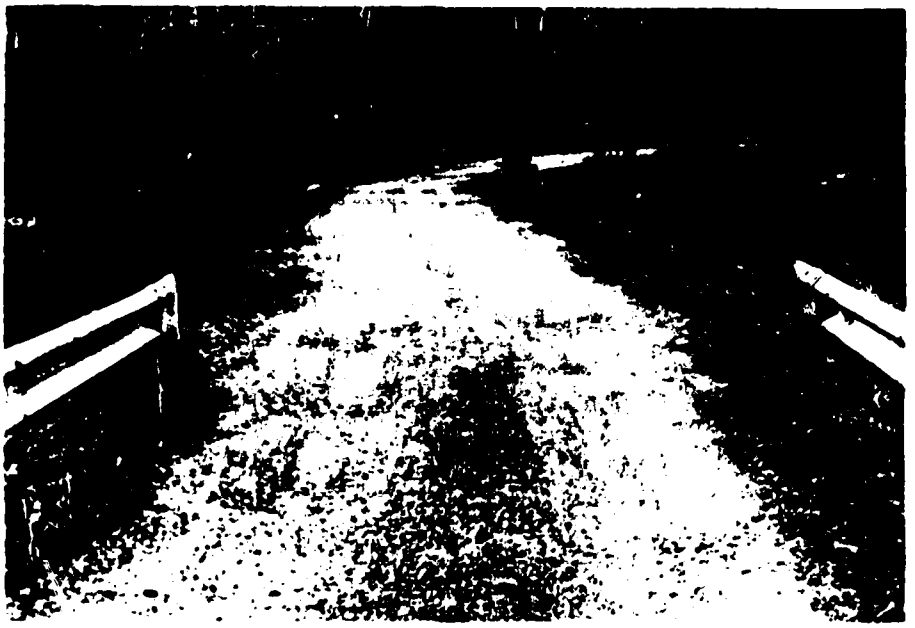
HYDROMETEOROLOGICAL GAGES: None

MAXIMUM NON-DAMAGING DISCHARGE: 114 cfs

APPENDIX 2

PHOTOGRAPHS

DEER PARK POND DAM



April 22, 1981

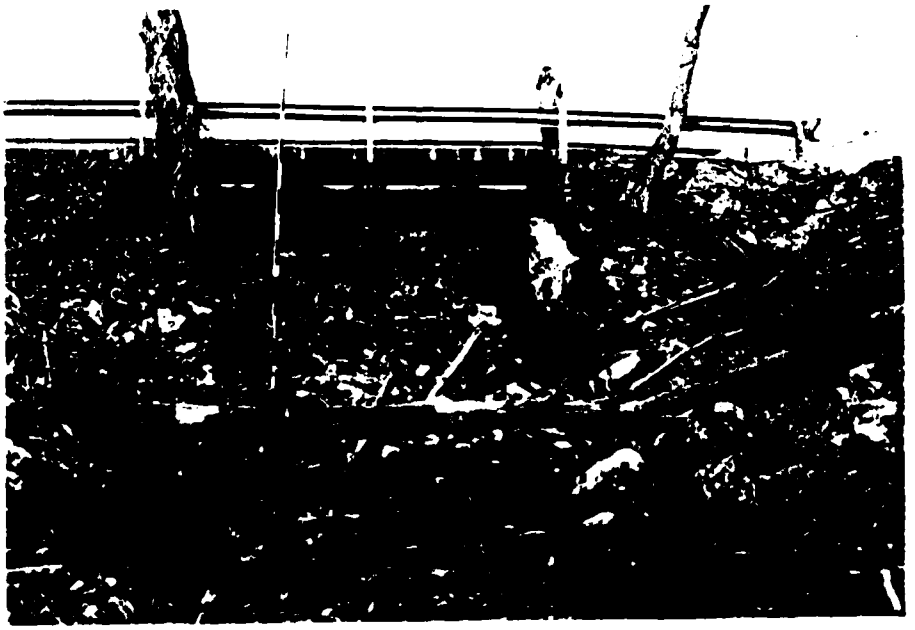
iew of crest toward right abutment from center of spillway bridge.

April 22, 1981

View looking along upstream side of dam and bridge over spillway. Note concrete training walls and apron leading to spillway crest under concrete-slab bridge.

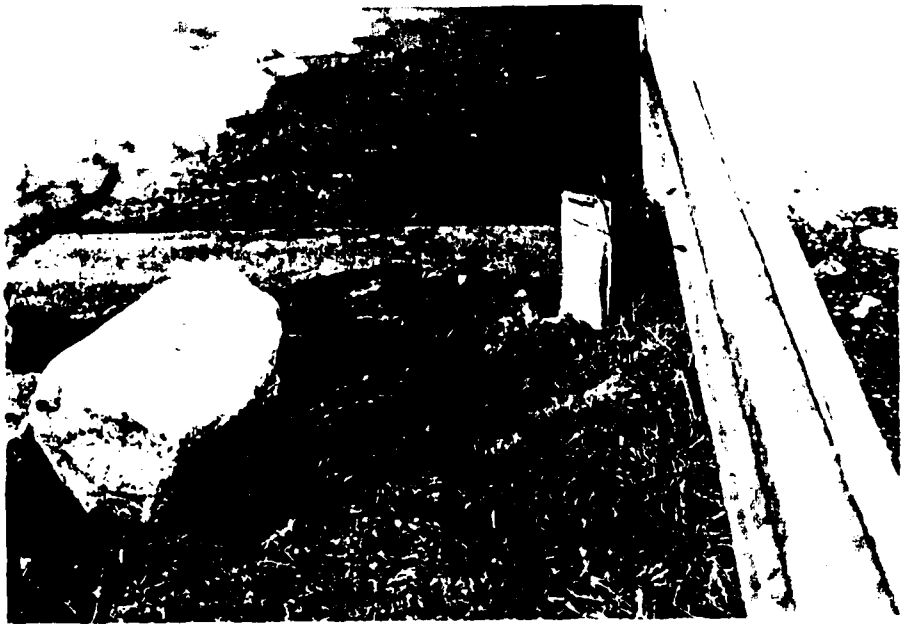
April 22, 1981

View looking upstream at left side of spillway; note that water disappears into rock bottom at approximately the center of the photo. Note also erosion from trespassing below guard rail.



April 22, 1981

View looking at spillway crest and downstream face of spillway; note that water disappearing into bottom reappears at spillway toe.



April 22, 1981

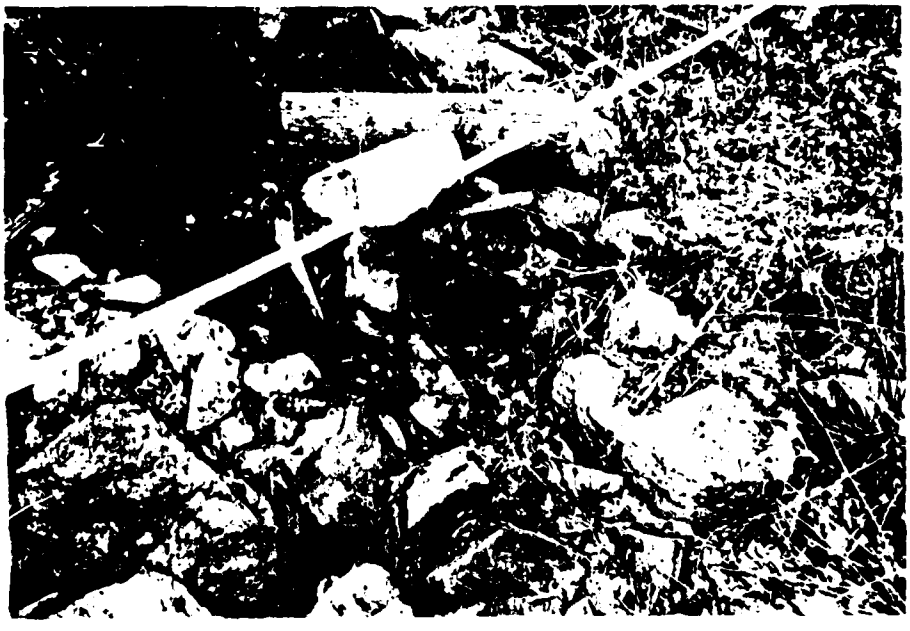
View of right spillway training wall on upstream side; note spalled concrete.

April 22, 1981

View of underside of road bridge over spillway; note that bridge column nearly rusted away at footing.

April 22, 1981

Cracks in concrete apron of spillway on upstream side.



April 22, 1981

Outlet end of 12-inch cast iron pipe of low-level outlet under left side of downstream spillway face.

April 22, 1981

Outlet end of 12-inch cast iron pipe of low-level outlet under right side of downstream spillway face. (These pipes are 15 feet center to center.)

April 22, 1981

View of zone of standing water about 50 feet wide at toe of dam to left of spillway.

April 22, 1981

Slight seepage, adjacent to red flagging, slightly above pond shown in view above.

April 22, 1981

View of large wet area 30 feet wide and extending from 30 feet to 60 feet downstream of dam left of the downstream channel.

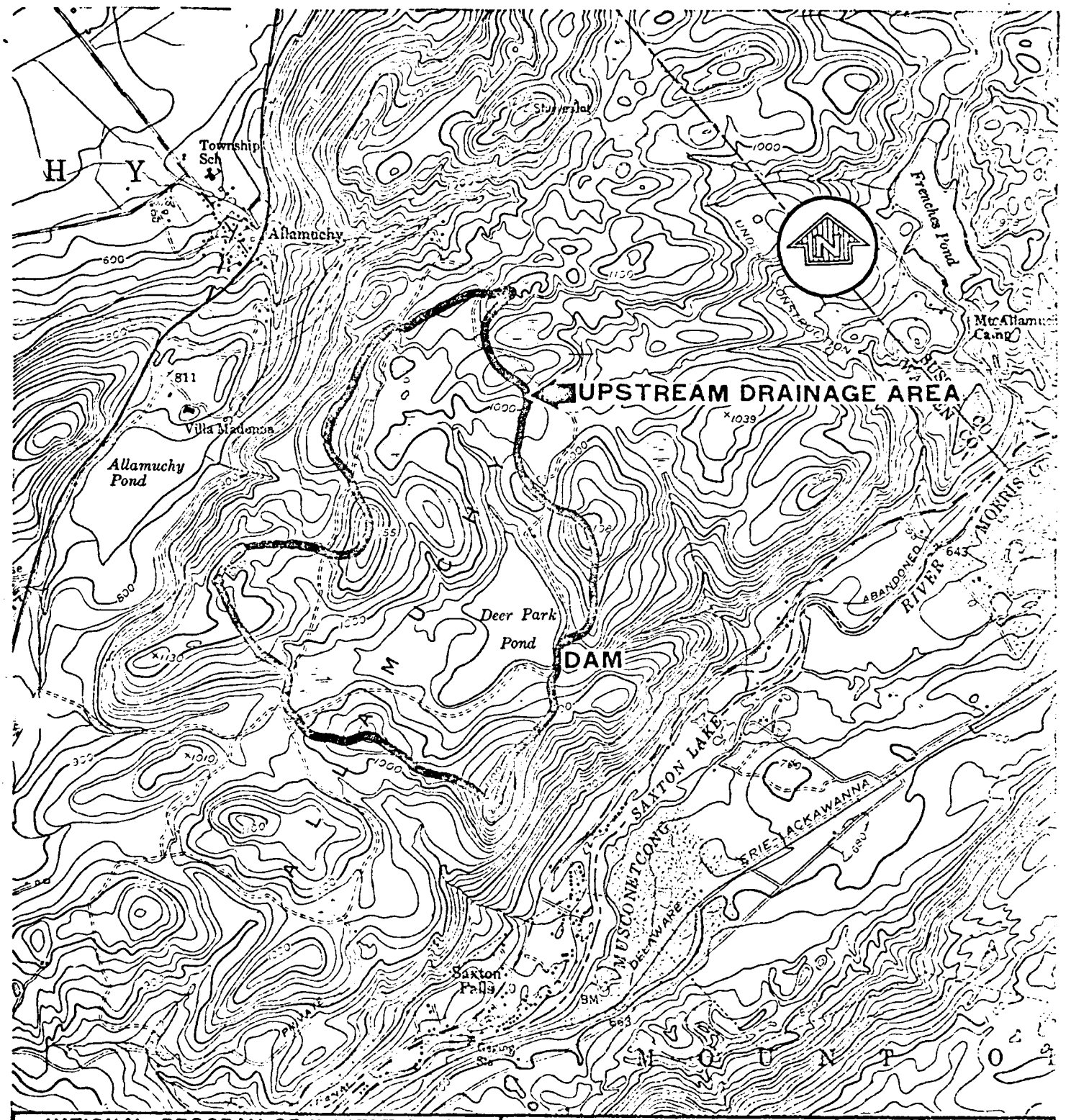
April 22, 1981

View of left edge of downstream channel; note seepage from channel bank and from rocks at left side of photo.

APPENDIX 3

HYDROLOGIC COMPUTATIONS

DEER PARK POND DAM



NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

DEER PARK POND DAM
ALLAMUCHY TOWNSHIP, NEW JERSEY

REGIONAL VICINITY MAP

JUNE 1981

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

Anderson-Nichols & Company, Inc. BOSTON, MA.

SCALE IN MILES

0 1/2 1

MAP BASED ON U.S.G.S. 7.5 MINUTE QUADRANGLE SHEET TRANQUILITY, N.J. 1954, REVISED 1971.

Anderson-Nichols & Company, Inc.

Subject: Deer Park Pond

Sheet No. 1 of

Date 11/3/81

Computed

Checked CRP

JOB NO.

SQUARES 1/4 IN. SCALE

Time of Concentration

(1) Texas Highway Method

Overland 3,800 ft. Slope $= \frac{1100-935}{3,800} = 0.043 = 4.3\%$

for woodlands, v = 2.0 fps → Time $= \frac{3800}{2} = 1900$ sec = 0.53 hr

no channel.

(2) Soil and Water Conservation

$$L = 0.6\,T_c = \frac{l^{0.8}\,(S+1)^{1.67}}{9,000\,Y^{0.5}}$$

$$\rightarrow T_c = \frac{l^{0.8}\,(S+1)^{1.67}}{(0.6)\,9,000\,Y^{0.5}}$$

$l = 3800$ ft

$Y = 4.3\%$

CN = 70 for good condition woods of soil group C

$\rightarrow S = \frac{1000}{70} - 10 = 4.29$

$$T_c = \frac{3,800^{0.8}\;5.29^{1.67}}{0.6\,(9,000)\;4.3^{0.5}} = 1.05 \text{ hrs.}$$

(3) Weston, or SCS T.R. #55

Overland slope = 4.3% → V = 0.5 fps (from T.R. 55 graph for forest formation) length = 3,800 ft

$T_c = \frac{3800}{0.5} = 7,600$ sec = 2.11 hrs

No channel

(4) Kerby

Overland, $T_c = 0.83 \left(\frac{Nl}{\sqrt{s}}\right)^{0.467}$ $N = 0.7$, $l = 3{,}800$, $s = 0.043$

$= 0.83 \left(\frac{0.7 \; 3{,}800}{\sqrt{0.043}}\right)^{0.467} = 68.8 \text{ min} = 1.15 \text{ hrs.}$

Avg $= \frac{0.53 + 1.05 + 2.11 + 1.15}{4} = 1.21$ hrs. $\rightarrow L = 0.6\, T_c = 0.73$ hrs

Drainage area = 0.82 sq. mi.

Anderson-Nichols & Company, Inc. Subject Deer Park Pond

Sheet No. 3 of 11
Date 6/24/92
Computed
Checked CLP

JOB NO.

SQUARES 1/4 IN. SCALE

Stage-Discharge Curve

The hydraulic profile of Deer Park Pond Dam is shown on page 4 Assume 12" pipes closed.

Spillway

from 934.6 to 935.6, weir: $Q = 3.0\,(19.5)(E - 934.6)^{3/2}$

from 935.6 to 936.4, orifice. $Q = C a \sqrt{2g}\sqrt{h}$

p.72, Kng Handbook of Hydraulics, $C \approx 0.64$

h: height above midpt: $E - 935.1$

$Q = 0.64(19.5)(\quad)\left(\sqrt{E - 935.1}\right)$

$= 100.2\sqrt{E - 935.1}$

from 936.4 up, orifice + weir over top. $Q = 100.2\sqrt{E - 935.1} + 3.0(19.5)(E - 936$

Top of Dam

Sections 3, 4 & 7 *

from 936.4 to 936.9, $Q = 2.8(38.5)(E - 936.4)^{(3)}(0.5(E - 936.4))^{3/2}$

$+ 2.8(180.5)(E - 936.4)^{(4)3/2} + 2.8(166.7)(E - 936.4)^{(6)}(0.5(E - 936.4))^{3/2}$

from 936.9 to 937.0, $Q = 2.8(38.5)(E - 936.4)^{(3)}(0.5(E - 936.4))^{3/2} + 2.8(180.5)(E - 936$

$+ 2.8(166.7)(E - 936.4)^{(6)}(0.5(E - 936.4))^{3/2} + 2.8(400)(E - 936.9)^{(7)}(0.5(E - 936.7))^{3/2}$

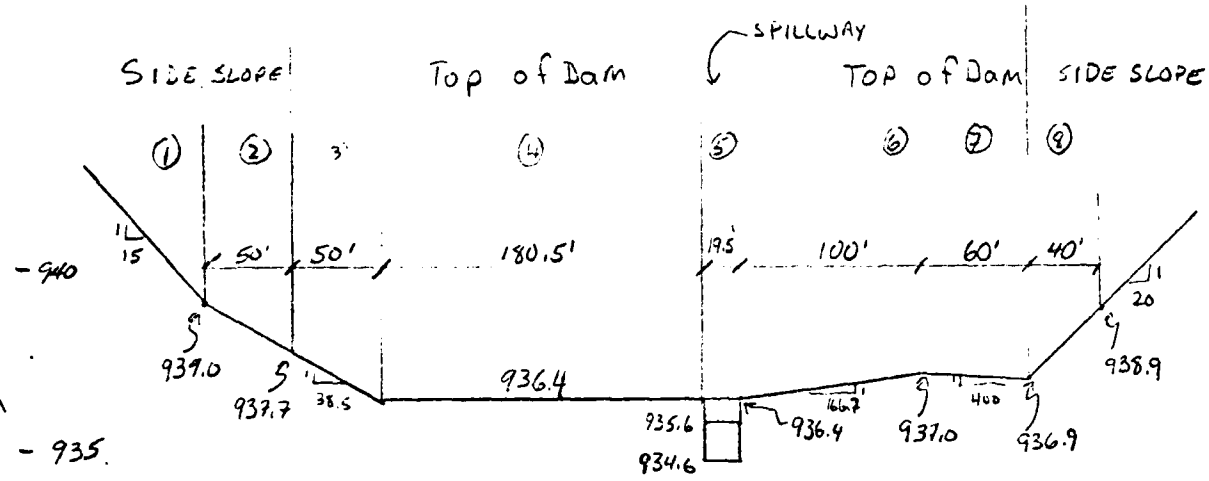
from 937.0 to 937.7, $Q = 2.8(38.5)^{(3)}(E - 936.4)(0.5(E - 936.4))^{3/2} + 2.8(180.5)(E - 936$

$+ 2.8(100)(E - 936.7)^{(5)3/2} + 2.8(60)(E - 936.95)^{(5)3/2}$

from 937.7 up, $Q = 2.8(50)(E - 937.05)^{(7)3/2} + 2.8(180.5)(E - 936.4)^{3/2}$

$+ 2.8(100)(E - 936.7)^{3/2} + 2.8(60)(E - 936.95)^{3/2}$

* for a sloping weir, $Q = C L H_{Avg}^{3/2}$



12" CIP, D/s invert at 921.7 - ⊗

⊗ - 12" CIP, D/s invert at 920.0

ANDERSON-NICHOLS

VERNON BOSTON CONCORD

DEER PARK POND DAM

HYDRAULIC PROFILE

DATE	SCALE	JOB NO.	SHEET NO.
6/24/81	1"=5' V 1"=100' H	3670-04	P. 4 of 11

Anderson-Nichols & Company, Inc.

Subject: Lake Tackford [illegible]

Sheet No. 6 of 11
Date 6 1978
Computed [illegible]
Checked [illegible]

JOB NO.

SQUARES IN. SCALE 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Side Slopes

Sections 1, 2, & 8

from 936.9 to 937.7

$$Q = 2.6\,(20)(E-936.9)\left[(0.5)(E-936.9)\right]^{3/2}$$

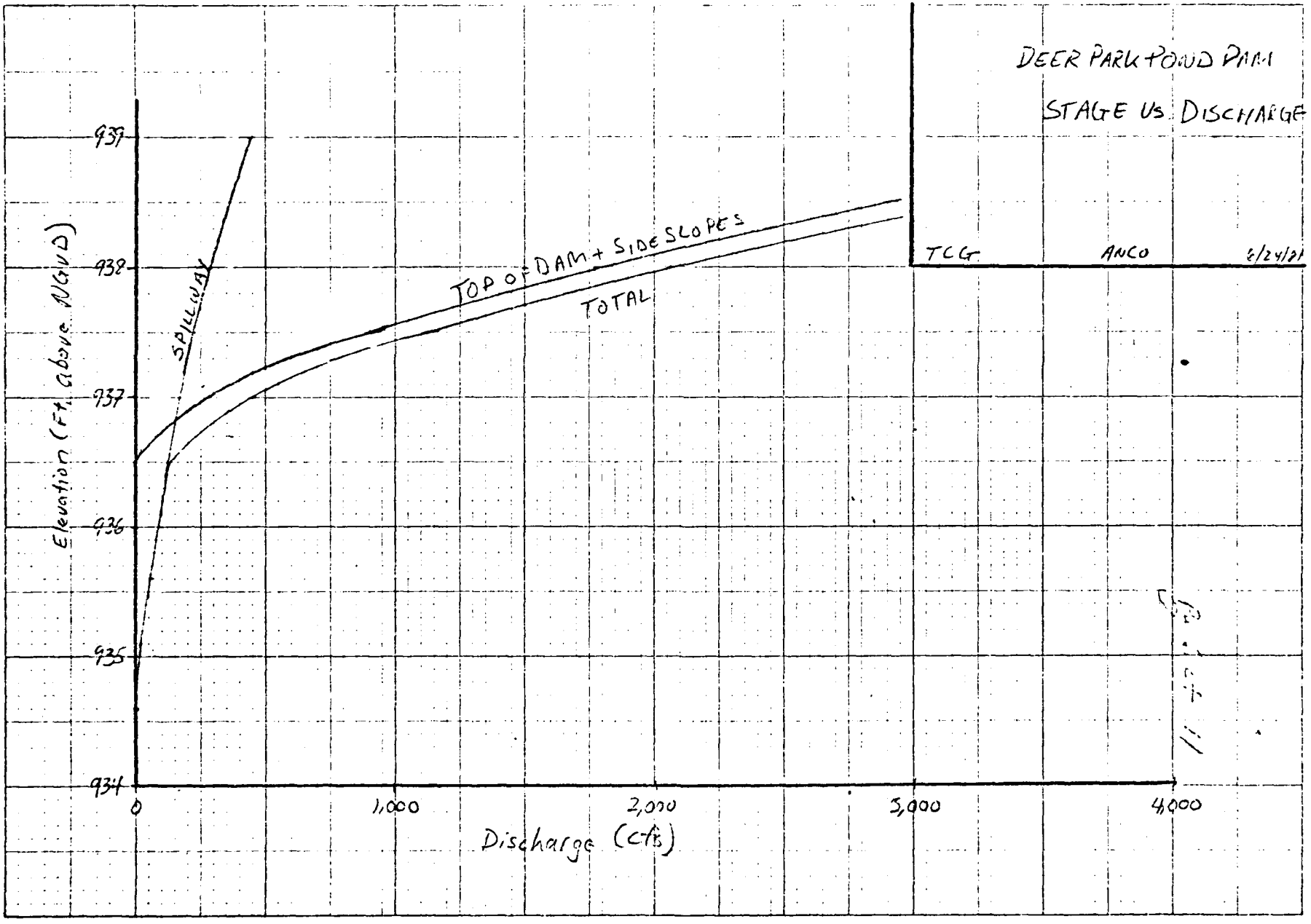
from 937.7 to 939.0

$$Q = 2.6(26.[illegible])(E-937.7)\left[(0.[illegible])(E-937.7)\right]^{3/2} + 2.6(20)([illegible] \ [illegible] \ [illegible])\left[[illegible] \ (E-936.9)\right]^{3/2}$$

from 939.0 up

$$Q = 2.6(15)(E-939.0)\left[([illegible])(E-939.0)\right]^{3/2} + 2.6([illegible] \ [illegible]) + 2.6(20)(E-936.9)\left[[illegible] \ (E-936.9)\right]^{3/2}$$

ELEVATION (ft. above NGVD)	DESCRIPTION	HEAD (ft) ON SPILLWAY (ft)	Q spillway (CFS)	Q T[illegible] ([illegible])	Q side [illegible] (CFS)	[illegible]
934.6	spillway crest	0.0	0	0	0	0
935.1		0.5	20.7	0	0	20.7
935.6	Top of s/w orifice	1.0	58.5	0	0	58.5
936.0		1.4	95.1	0	0	95.1
936.4	top of dam	1.8	114	0	0	114
937.0		2.4	165	293	0	458
937.5		2.9	223	900	5	1,128
938.0		3.4	289	1,748	25	2,062
939.0		4.4	443	3,970	186	4,599


DEER PARK POND DAM 1
STAGE Vs. DISCHARGE
TCG
ANCO
6/24/21
937
938
937
936
935
934
Elevation (Ft. above NGVD)
SPILLWAY
TOP OF DAM + SIDE SLOPES
TOTAL
0
1,000
2,000
3,000
4000
Discharge (cfs)

Anderson-Nichols & Company, Inc.

Subject Deer Park Pond

Sheet No. 1 of 1
Date 6/24/81
Computed TLC
Checked CLP

JOB NO.

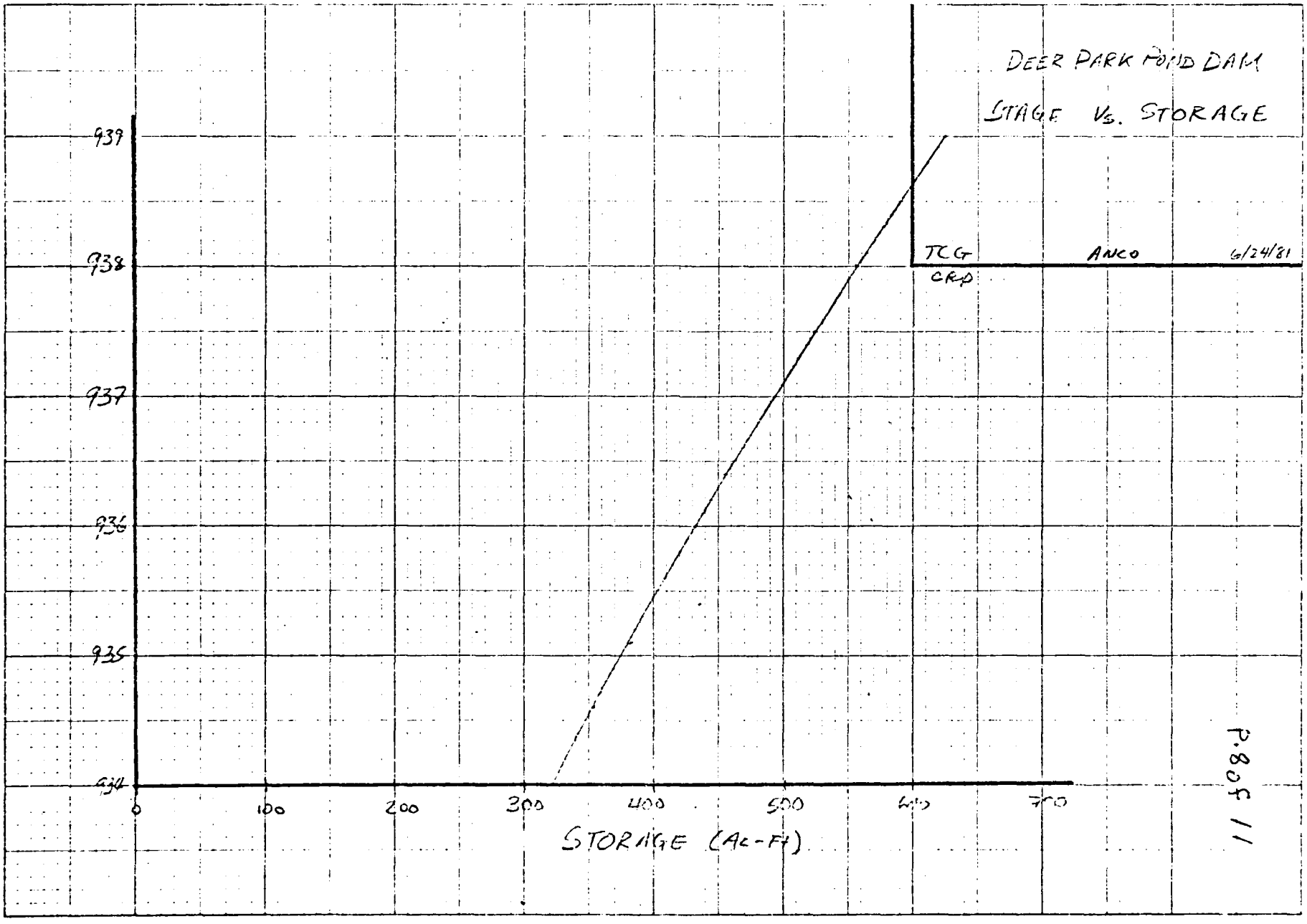
SQUARES 1/4 IN. SCALE

Stage Vs. Storage

Area at Pond Surface = 51.2 acres (934.6 ft.)
at Elev. 940 = 76.8 acres
at Elev. 960 = 128 acres

Assume linear increase in Area between points. Assume storage = 0.0 at 920.0, = 356 acre-ft at normal pool (934.6 ft.)

elevation (Ft. above NGVD)	Surface Area (Acres)	Avg. S.A. (Acres)	INCREMENTAL STORAGE (Ac-Ft)	CUMULATIVE STORAGE (Ac-Ft)
920.0	–			0
		–	356	
934.6	51.2			356
		52.4	26.2	
935.1	53.6			382.2
		54.75	27.4	
935.6	55.9			409.6
		56.85	27.7	
936	57.8			437.3
		58.75	23.5	
936.4	59.7			455.8
		61.15	36.7	
937	62.6			492.5
		63.75	31.9	
937.5	64.9			524.4
		66.1	33.0	
938	67.3			557.4
		69.7	69.7	
939	72.1			627.1


DEER PARK POND DAM
STAGE VS. STORAGE
TCG
CRD
ANCO
6/24/81
939
938
937
936
935
934
0
100
200
300
400
500
600
700
STORAGE (AC-FT)

P. 8 of 11

Anderson-Nichols & Company, Inc.

Subject Deer Park Road

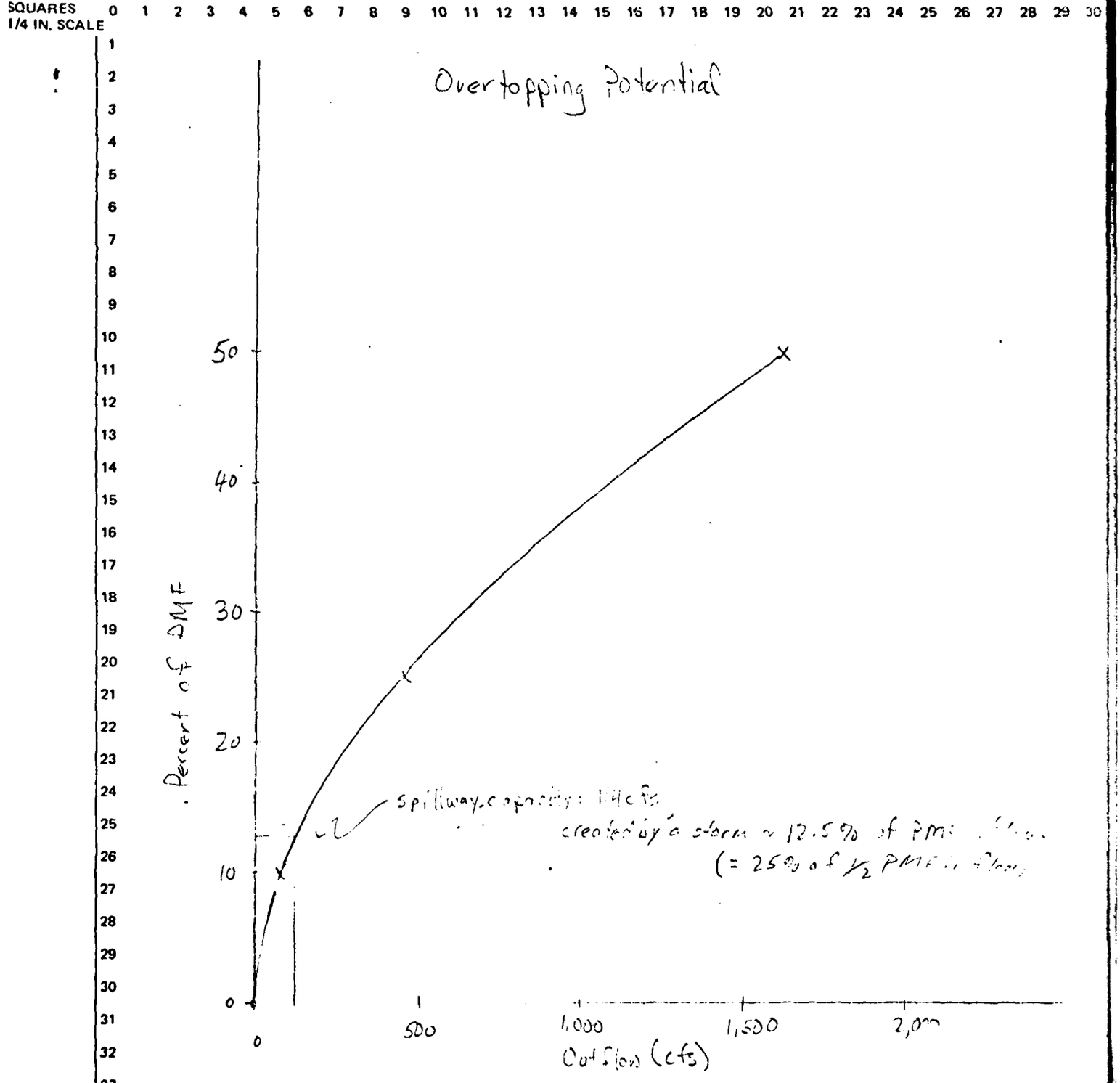
Sheet No. 9 of 11

Date 4/22/82

Computed

Checked SEP

JOB NO.



Anderson-Nichols & Company, Inc. Subject Deer Park Pond Sheet No. 15 of
Date
Computed
Checked SEP
JOB NO.

SQUARES 1/4 IN. SCALE

Drawdown Time

2-12" pipes for drawdown, u/s inverts at 921.7 and 920.5.

① Assume both open, acting as orifices with inlet control. Assume C = 0.61, and u/s inverts at same elevation as D/s.

$$Q = Q_1 + Q_2 = C_1 A_1 \sqrt{2g}\sqrt{H_1} + C_2 A_2 \sqrt{2g}\sqrt{H_2}$$

$C_1 = C_2 = 0.61$

$A_1 = A_2 = \pi (0.5)^2 = 0.785\ ft^2$

H_1 Height above 920.5 = E - 920.5

H_2 = height above 922.2 = E - 922.2

So $Q = 3.84 \left(\sqrt{E-920.5} + \sqrt{E-922.2}\right)$

② As for storage below water surface, assume: Storage $= Ah^N$ at elev. 934.6, $h = 14.6$, storage = 56. At 935.1, $h = 15.6$, storage = 409.6. So:

$$409.6 = A\ 15.6^N$$
$$\ln 409.6 = \ln A + N \ln 15.6$$
$$\ln A = 6.02 - 2.75N$$

and $356 = A\ 14.6^N$

$$\ln 356 = \ln A + N \ln 14.6$$
$$\ln 356 = 6.02 - 2.75N + N \ln 14.6$$
$$5.87 - 6.02 = -2.75N + 2.68N$$
$$N = 2.14$$
$$\rightarrow \ln A = 6.02 - 2.75(2.14) = 0.135 \rightarrow A = 1.14$$

So Storage $= 1.14\ h^{2.14}$.

③ $Q = 1.98\ \Delta S$

④ Days = $\frac{\Delta S}{Ac\text{-}ft/day}$

⑤ No inflow

Anderson-Nichols & Company, Inc.

Subject Deer Park Pond

Sheet No. 11 of 11
Date 4-2-82
Computed CEH
Checked CEH

JOB NO.

SQUARES 1/4 IN. SCALE

Elevation (Ft above NGVD)	Storage (Ac-Ft)	ΔS (Ac-Ft)	Q (CFS)	Q avg (CFS)	Ac-Ft per Day	DAYS
934.6	356		27.9			
		124		26.45	52.4	2.37
932	232		25.0			
		75		23.8	47.1	1.59
930	157		22.6			
		59		21.2	42.0	1.40
928	98		19.8			
		45		18.15	35.9	1.25
926	53		16.5			
		31		14.4	28.5	1.09
924	22		12.3			
		17		8.5	16.8	1.01
922	5		4.7			
		5		2.35	4.7	1.07
0	0		0			

Σ = 9.78 days

APPENDIX 4

HEC-1 OUTPUT

DEER PARK POND DAM

```
LINE      ID.....1.....2.....3.....4....    .....6.....7.....8.....9.....10
   1      ID   DEER PARK POND DAM    OVERTOPPING ANALYSIS   TOM GOOCH   ANCO
   2      ID   NEW JERSEY DAM NO. 502 - WARREN COUNTY - ALLAMUCKY TOWNSHIP
   3      IO   0.1,0.25,0.5 MULTIPLES OF PMF FROM 6-HOUR PMP
   4      IT     5                0      300
   5      IO     2         1
   6      JR   FLOW      0.1     0.25      0.5

   7      KK     A1  DEVELOP INFLOW HYDROGRAPH TO DEER PARK POND
   8      KM     INFLOW FROM SCS UNIT GRAPH COMPUTATIONS
   9      BA   0.82        0
  10      RF    2.5      2.5        1
  11      PM   22.9                          NO      113      123      132
  12      LU      1      0.1
  13      UD   0.73

  14      KK     A2  ROUTE INFLOW HYDROGRAPH THROUGH DEER PARK POND
  15      RS      1    STOR      356.
  16      SV     0.     356.    382.2    409.6    432.3    455.8    492.5    524.4    557.4    627.1
  17      SE    920.    934.6   935.1    935.6    936.     936.4    937.     937.5    938.     939.
  18      SQ     0.0      0.     20.7     58.5     95.1     114.     458.    1128.    2362.    4599.
  19      SE    920.    934.6   935.1    935.6    936.     936.4    937.     937.5    938.     939.
  20      SS   934.6     19.5     3.0      1.5
  21      ST   936.4    390.5     0.0      1.5
  22      ZZ
```

```
*****************************************
*                                       *
*    1000 HYDROGRAPH PACKAGE  (HEC-1)   *
*          FEBRUARY 1981                *
*                                       *
*                                       *
*  RUN DATE06/30/81      TIME11.44.23   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*  THE HYDROLOGIC ENGINEERING CENTE     *
*        609 SECOND STREET              *
*      DAVIS, CALIFORNIA 95616          *
*  (916) 440-3285 OR (FTS) 448-3285     *
*                                       *
*****************************************
```

DEER PARK POND DAM OVERTOPPING ANALYSIS TOM GOOCH ANCO
NEW JERSEY DAM NO. 502 - WARREN COUNTY - ALLAMUCKY TOWNSHIP
0.1,0.25,0.5 MULTIPLES OF PMF FROM 24-HOUR PMP

```
    5 IO        OUTPUT CONTROL VARIABLES
                  IPRNT        2  PRINT CONTROL
                  IPLOT        1  PLOT CONTROL
                  QSCAL        0. HYDROGRAPH PLOT SCALE
                   DMSG      YES  PRINT DIAGNOSTIC MESSAGES

      IT        HYDROGRAPH TIME DATA
                   NMIN        5  MINUTES IN COMPUTATION INTERVAL
                  IDATE    1   0  STARTING DATE
                  ITIME     0000  STARTING TIME
                     NQ      300  NUMBER OF HYDROGRAPH ORDINATES
                  NDDATE   2   0  ENDING DATE
                  NDTIME     0055  ENDING TIME

                COMPUTATION INTERVAL    0.08 HOURS
                   TOTAL TIME BASE   24.92 HOURS

      ENGLISH UNITS
           DRAINAGE AREA          SQUARE MILES
           PRECIPITATION DEPTH    INCHES
           LENGTH, ELEVATION      FEET
           FLOW                   CUBIC FEET PER SECOND
           STORAGE VOLUME         ACRE-FEET
           SURFACE AREA           ACRES
           TEMPERATURE            DEGREES FAHRENHEIT

      JP        MULTI-PLAN OPTION
                  NPLAN        1  NUMBER OF PLANS

      JR        MULTI-RATIO OPTION
                  RATIOS OF RUNOFF
                0.10      0.25      0.50
```

*** ***

```
            ***************
            *             *
    7 KK    *      A1     *      DEVELOP INFLOW HYDROGRAPH TO DEER PARK POND
            *             *
            ***************
                        INFLOW FROM SCS UNIT GRAPH COMPUTATIONS

          SUBBASIN RUNOFF DATA

    9 BA        SUBBASIN CHARACTERISTICS
                  TAREA      0.82  SUBBASIN AREA

   10 BF        BASE FLOW CHARACTERISTICS
                  STRTQ      2.50  INITIAL FLOW
                  QRCSN      2.50  BEGIN BASE FLOW RECESSION
                  RTIOR   1.00000  RECESSION CONSTANT
```

PRECIPITATION DATA

11 PM PROBABLE MAXIMUM STORM

PMS	22.90	INDEX PRECIPITATION
TRSPC	0.80	TRANSPOSITION COEFFICIENT
TRSDA	0.82	TRANSPOSITION AREA
SWD	ND	USE SWD DISTRIBUTION

PERCENT OF INDEX PRECIPITATION OCCURRING IN GIVEN TIME

6-HR	12-HR	24-HR	48-HR	72-HR	96-HR
113.0	123.0	132.0	0.0	0.0	0.0

12 LU UNIFORM LOSS RATE

STRTL	1.00	INITIAL LOSS
CNSTL	0.10	UNIFORM LOSS RATE
RTIMP	0.0	PERCENT IMPERVIOUS AREA

13 UD SCS DIMENSIONLESS UNITGRAPH

TLAG	0.73	LAG

***

UNIT HYDROGRAPH
46 END-OF-PERIOD ORDINATES

18.	59.	112.	185.	280.	378.	453.	497.	512.	509.
481.	443.	399.	342.	277.	226.	189.	158.	134.	114.
96.	79.	67.	56.	47.	39.	33.	27.	23.	19.
16.	14.	12.	10.	8.	7.	6.	5.	4.	4.
3.	2.	2.	1.	1.	0.				

HYDROGRAPH AT STATION A1

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1		0000	1	0.0	0.0	0.0	3.	1		1230	151	0.17	0.01	0.16	263.
1		0005	2	0.01	0.01	0.00	3.	1		1235	152	0.17	0.01	0.16	330.
1		0010	3	0.01	0.01	0.00	3.	1		1240	153	0.17	0.01	0.16	403.
1		0015	4	0.01	0.01	0.00	3.	1		1245	154	0.17	0.01	0.16	476.
1		0020	5	0.01	0.01	0.00	3.	1		1250	155	0.17	0.01	0.16	553.
1		0025	6	0.01	0.01	0.00	3.	1		1255	156	0.17	0.01	0.16	624.
1		0030	7	0.01	0.01	0.00	3.	1		1300	157	0.17	0.01	0.16	696.
1		0035	8	0.01	0.01	0.00	3.	1		1305	158	0.21	0.01	0.20	748.
1		0040	9	0.01	0.01	0.00	3.	1		1310	159	0.21	0.01	0.20	801.
1		0045	10	0.01	0.01	0.00	3.	1		1315	160	0.21	0.01	0.20	845.
1		0050	11	0.01	0.01	0.00	3.	1		1320	161	0.21	0.01	0.20	885.
1		0055	12	0.01	0.01	0.00	3.	1		1325	162	0.21	0.01	0.20	922.
1		0100	13	0.01	0.01	0.00	3.	1		1330	163	0.21	0.01	0.20	956.
1		0105	14	0.01	0.01	0.00	3.	1		1335	164	0.21	0.01	0.20	994.
1		0110	15	0.01	0.01	0.00	3.	1		1340	165	0.21	0.01	0.20	1028.
1		0115	16	0.01	0.01	0.00	3.	1		1345	166	0.21	0.01	0.20	1060.
1		0120	17	0.01	0.01	0.00	3.	1		1350	167	0.21	0.01	0.20	1089.
1		0125	18	0.01	0.01	0.00	3.	1		1355	168	0.21	0.01	0.20	1115.
1		0130	19	0.01	0.01	0.00	3.	1		1400	169	0.21	0.01	0.20	1139.
1		0135	20	0.01	0.01	0.00	3.	1		1405	170	0.26	0.01	0.25	1161.
1		0140	21	0.01	0.01	0.00	3.	1		1410	171	0.26	0.01	0.25	1181.
1		0145	22	0.01	0.01	0.00	3.	1		1415	172	0.26	0.01	0.25	1201.
1		0150	23	0.01	0.01	0.00	3.	1		1420	173	0.26	0.01	0.25	1223.
1		0155	24	0.01	0.01	0.00	3.	1		1425	174	0.26	0.01	0.25	1247.
1		0200	25	0.01	0.01	0.00	3.	1		1430	175	0.26	0.01	0.25	1275.
1		0205	26	0.01	0.01	0.00	3.	1		1435	176	0.26	0.01	0.25	1306.
1		0210	27	0.01	0.01	0.00	3.	1		1440	177	0.26	0.01	0.25	1337.
1		0215	28	0.01	0.01	0.00	3.	1		1445	178	0.26	0.01	0.25	1369.
1		0220	29	0.01	0.01	0.00	3.	1		1450	179	0.26	0.01	0.25	1394.
1		0225	30	0.01	0.01	0.00	3.	1		1455	180	0.26	0.01	0.25	1426.

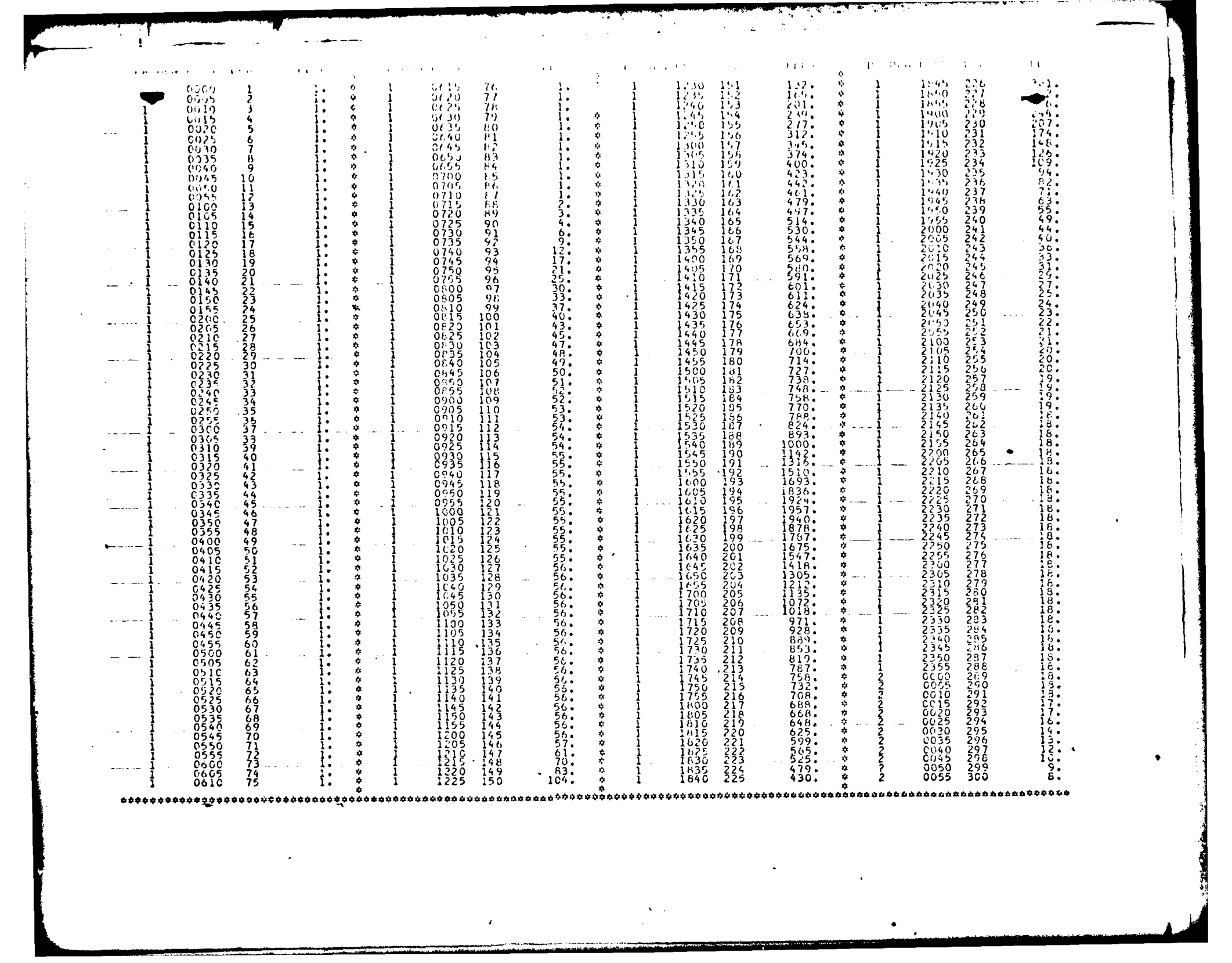
1	0230	31	0.01	0.01	0.00	3.	*		1	1500	181	0.26	0.01	0.25	1454.
1	0235	32	0.01	0.01	0.00	3.	*		1	1505	182	0.24	0.01	0.23	1476.
1	0240	33	0.01	0.01	0.00	3.	*		1	1510	183	0.31	0.01	0.31	1496.
1	0245	34	0.01	0.01	0.00	3.	*		1	1515	184	0.39	0.01	0.38	1516.
1	0250	35	0.01	0.01	0.00	3.	*		1	1520	185	0.47	0.01	0.46	1540.
1	0255	36	0.01	0.01	0.00	3.	*		1	1525	186	0.71	0.01	0.70	1577.
1	0300	37	0.01	0.01	0.00	3.	*		1	1530	187	1.34	0.01	1.33	1648.
1	0305	38	0.01	0.01	0.00	3.	*		1	1535	188	1.97	0.01	1.96	1787.
1	0310	39	0.01	0.01	0.00	3.	*		1	1540	189	0.87	0.01	0.86	2001.
1	0315	40	0.01	0.01	0.00	3.	*		1	1545	190	0.63	0.01	0.62	2284.
1	0320	41	0.01	0.01	0.00	3.	*		1	1550	191	0.39	0.01	0.38	2632.
1	0325	42	0.01	0.01	0.00	3.	*		1	1555	192	0.31	0.01	0.31	3020.
1	0330	43	0.01	0.01	0.00	3.	*		1	1600	193	0.24	0.01	0.23	3386.
1	0335	44	0.01	0.01	0.00	3.	*		1	1605	194	0.24	0.01	0.23	3671.
1	0340	45	0.01	0.01	0.00	3.	*		1	1610	195	0.24	0.01	0.23	3848.
1	0345	46	0.01	0.01	0.00	3.	*		1	1615	196	0.24	0.01	0.23	3913.
1	0350	47	0.01	0.01	0.00	3.	*		1	1620	197	0.24	0.01	0.23	3879.
1	0355	48	0.01	0.01	0.00	3.	*		1	1625	198	0.24	0.01	0.23	3755.
1	0400	49	0.01	0.01	0.00	3.	*		1	1630	199	0.24	0.01	0.23	3574.
1	0405	50	0.01	0.01	0.00	3.	*		1	1635	200	0.24	0.01	0.23	3350.
1	0410	51	0.01	0.01	0.00	3.	*		1	1640	201	0.24	0.01	0.23	3094.
1	0415	52	0.01	0.01	0.00	3.	*		1	1645	202	0.24	0.01	0.23	2836.
1	0420	53	0.01	0.01	0.00	3.	*		1	1650	203	0.24	0.01	0.23	2610.
1	0425	54	0.01	0.01	0.00	3.	*		1	1655	204	0.24	0.01	0.23	2423.
1	0430	55	0.01	0.01	0.00	3.	*		1	1700	205	0.24	0.01	0.23	2269.
1	0435	56	0.01	0.01	0.00	3.	*		1	1705	206	0.19	0.01	0.18	2143.
1	0440	57	0.01	0.01	0.00	3.	*		1	1710	207	0.19	0.01	0.18	2036.
1	0445	58	0.01	0.01	0.00	3.	*		1	1715	208	0.19	0.01	0.18	1941.
1	0450	59	0.01	0.01	0.00	3.	*		1	1720	209	0.19	0.01	0.18	1856.
1	0455	60	0.01	0.01	0.00	3.	*		1	1725	210	0.19	0.01	0.18	1778.
1	0500	61	0.01	0.01	0.00	3.	*		1	1730	211	0.19	0.01	0.18	1705.
1	0505	62	0.01	0.01	0.00	3.	*		1	1735	212	0.19	0.01	0.18	1636.
1	0510	63	0.01	0.01	0.00	3.	*		1	1740	213	0.19	0.01	0.18	1574.
1	0515	64	0.01	0.01	0.00	3.	*		1	1745	214	0.19	0.01	0.18	1516.
1	0520	65	0.01	0.01	0.00	3.	*		1	1750	215	0.19	0.01	0.18	1463.
1	0525	66	0.01	0.01	0.00	3.	*		1	1755	216	0.19	0.01	0.18	1417.
1	0530	67	0.01	0.01	0.00	3.	*		1	1800	217	0.19	0.01	0.18	1376.
1	0535	68	0.01	0.01	0.00	3.	*		1	1805	218	0.01	0.01	0.01	1336.
1	0540	69	0.01	0.01	0.00	3.	*		1	1810	219	0.01	0.01	0.01	1296.
1	0545	70	0.01	0.01	0.00	3.	*		1	1815	220	0.01	0.01	0.01	1251.
1	0550	71	0.01	0.01	0.00	3.	*		1	1820	221	0.01	0.01	0.01	1197.
1	0555	72	0.01	0.01	0.00	3.	*		1	1825	222	0.01	0.01	0.01	1130.
1	0600	73	0.01	0.01	0.00	3.	*		1	1830	223	0.01	0.01	0.01	1049.
1	0605	74	0.03	0.03	0.00	3.	*		1	1835	224	0.01	0.01	0.01	957.
1	0610	75	0.03	0.03	0.00	3.	*		1	1840	225	0.01	0.01	0.01	860.
1	0615	76	0.03	0.03	0.00	3.	*		1	1845	226	0.01	0.01	0.01	761.
1	0620	77	0.03	0.03	0.00	3.	*		1	1850	227	0.01	0.01	0.01	664.
1	0625	78	0.03	0.03	0.00	3.	*		1	1855	228	0.01	0.01	0.01	573.
1	0630	79	0.03	0.03	0.00	3.	*		1	1900	229	0.01	0.01	0.01	489.
1	0635	80	0.03	0.03	0.00	3.	*		1	1905	230	0.01	0.01	0.01	413.
1	0640	81	0.03	0.03	0.00	3.	*		1	1910	231	0.01	0.01	0.01	349.
1	0645	82	0.03	0.03	0.00	3.	*		1	1915	232	0.01	0.01	0.01	296.
1	0650	83	0.03	0.03	0.00	3.	*		1	1920	233	0.01	0.01	0.01	253.
1	0655	84	0.03	0.03	0.00	3.	*		1	1925	234	0.01	0.01	0.01	217.
1	0700	85	0.03	0.03	0.00	3.	*		1	1930	235	0.01	0.01	0.01	188.
1	0705	86	0.03	0.03	0.00	3.	*		1	1935	236	0.01	0.01	0.01	163.
1	0710	87	0.03	0.01	0.01	3.	*		1	1940	237	0.01	0.01	0.01	142.
1	0715	88	0.03	0.01	0.02	3.	*		1	1945	238	0.01	0.01	0.01	125.
1	0720	89	0.03	0.01	0.02	5.	*		1	1950	239	0.01	0.01	0.01	111.
1	0725	90	0.03	0.01	0.02	8.	*		1	1955	240	0.01	0.01	0.01	98.
1	0730	91	0.03	0.01	0.02	12.	*		1	2000	241	0.01	0.01	0.01	88.
1	0735	92	0.03	0.01	0.02	18.	*		1	2005	242	0.01	0.01	0.01	80.
1	0740	93	0.03	0.01	0.02	25.	*		1	2010	243	0.01	0.01	0.01	72.
1	0745	94	0.03	0.01	0.02	33.	*		1	2015	244	0.01	0.01	0.01	66.
1	0750	95	0.03	0.01	0.02	42.	*		1	2020	245	0.01	0.01	0.01	61.
1	0755	96	0.03	0.01	0.02	51.	*		1	2025	246	0.01	0.01	0.01	57.
1	0800	97	0.03	0.01	0.02	59.	*		1	2030	247	0.01	0.01	0.01	54.

1	0805	98	0.03	0.01	0.02	67.	*	1	2035	248	0.01	0.01	0.01	51.
1	0810	99	0.03	0.01	0.02	74.	*	1	2040	249	0.01	0.01	0.01	48.
1	0815	100	0.03	0.01	0.02	80.	*	1	2045	250	0.01	0.01	0.01	46.
1	0820	101	0.03	0.01	0.02	85.	*	1	2050	251	0.01	0.01	0.01	44.
1	0825	102	0.03	0.01	0.02	90.	*	1	2055	252	0.01	0.01	0.01	43.
1	0830	103	0.03	0.01	0.02	93.	*	1	2100	253	0.01	0.01	0.01	42.
1	0835	104	0.03	0.01	0.02	96.	*	1	2105	254	0.01	0.01	0.01	41.
1	0840	105	0.03	0.01	0.02	98.	*	1	2110	255	0.01	0.01	0.01	40.
1	0845	106	0.03	0.01	0.02	100.	*	1	2115	256	0.01	0.01	0.01	39.
1	0850	107	0.03	0.01	0.02	102.	*	1	2120	257	0.01	0.01	0.01	38.
1	0855	108	0.03	0.01	0.02	104.	*	1	2125	258	0.01	0.01	0.01	38.
1	0900	109	0.03	0.01	0.02	105.	*	1	2130	259	0.01	0.01	0.01	38.
1	0905	110	0.03	0.01	0.02	106.	*	1	2135	260	0.01	0.01	0.01	37.
1	0910	111	0.03	0.01	0.02	107.	*	1	2140	261	0.01	0.01	0.01	37.
1	0915	112	0.03	0.01	0.02	108.	*	1	2145	262	0.01	0.01	0.01	37.
1	0920	113	0.03	0.01	0.02	108.	*	1	2150	263	0.01	0.01	0.01	37.
1	0925	114	0.03	0.01	0.02	109.	*	1	2155	264	0.01	0.01	0.01	37.
1	0930	115	0.03	0.01	0.02	109.	*	1	2200	265	0.01	0.01	0.01	37.
1	0935	116	0.03	0.01	0.02	109.	*	1	2205	266	0.01	0.01	0.01	37.
1	0940	117	0.03	0.01	0.02	110.	*	1	2210	267	0.01	0.01	0.01	37.
1	0945	118	0.03	0.01	0.02	110.	*	1	2215	268	0.01	0.01	0.01	37.
1	0950	119	0.03	0.01	0.02	110.	*	1	2220	269	0.01	0.01	0.01	37.
1	0955	120	0.03	0.01	0.02	110.	*	1	2225	270	0.01	0.01	0.01	37.
1	1000	121	0.03	0.01	0.02	111.	*	1	2230	271	0.01	0.01	0.01	37.
1	1005	122	0.03	0.01	0.02	111.	*	1	2235	272	0.01	0.01	0.01	37.
1	1010	123	0.03	0.01	0.02	111.	*	1	2240	273	0.01	0.01	0.01	37.
1	1015	124	0.03	0.01	0.02	111.	*	1	2245	274	0.01	0.01	0.01	37.
1	1020	125	0.03	0.01	0.02	111.	*	1	2250	275	0.01	0.01	0.01	37.
1	1025	126	0.03	0.01	0.02	111.	*	1	2255	276	0.01	0.01	0.01	37.
1	1030	127	0.03	0.01	0.02	111.	*	1	2300	277	0.01	0.01	0.01	37.
1	1035	128	0.03	0.01	0.02	111.	*	1	2305	278	0.01	0.01	0.01	37.
1	1040	129	0.03	0.01	0.02	111.	*	1	2310	279	0.01	0.01	0.01	37.
1	1045	130	0.03	0.01	0.02	111.	*	1	2315	280	0.01	0.01	0.01	37.
1	1050	131	0.03	0.01	0.02	111.	*	1	2320	281	0.01	0.01	0.01	37.
1	1055	132	0.03	0.01	0.02	111.	*	1	2325	282	0.01	0.01	0.01	37.
1	1100	133	0.03	0.01	0.02	111.	*	1	2330	283	0.01	0.01	0.01	37.
1	1105	134	0.03	0.01	0.02	111.	*	1	2335	284	0.01	0.01	0.01	37.
1	1110	135	0.03	0.01	0.02	111.	*	1	2340	285	0.01	0.01	0.01	37.
1	1115	136	0.03	0.01	0.02	111.	*	1	2345	286	0.01	0.01	0.01	37.
1	1120	137	0.03	0.01	0.02	111.	*	1	2350	287	0.01	0.01	0.01	37.
1	1125	138	0.03	0.01	0.02	111.	*	1	2355	288	0.01	0.01	0.01	37.
1	1130	139	0.03	0.01	0.02	111.	*	2	0000	289	0.0	0.0	0.0	37.
1	1135	140	0.03	0.01	0.02	111.	*	2	0005	290	0.0	0.0	0.0	36.
1	1140	141	0.03	0.01	0.02	111.	*	2	0010	291	0.0	0.0	0.0	36.
1	1145	142	0.03	0.01	0.02	111.	*	2	0015	292	0.0	0.0	0.0	35.
1	1150	143	0.03	0.01	0.02	111.	*	2	0020	293	0.0	0.0	0.0	33.
1	1155	144	0.03	0.01	0.02	111.	*	2	0025	294	0.0	0.0	0.0	31.
1	1200	145	0.03	0.01	0.02	111.	*	2	0030	295	0.0	0.0	0.0	29.
1	1205	146	0.17	0.01	0.16	114.	*	2	0035	296	0.0	0.0	0.0	26.
1	1210	147	0.17	0.01	0.16	122.	*	2	0040	297	0.0	0.0	0.0	23.
1	1215	148	0.17	0.01	0.16	139.	*	2	0045	298	0.0	0.0	0.0	21.
1	1220	149	0.17	0.01	0.16	166.	*	2	0050	299	0.0	0.0	0.0	18.
1	1225	150	0.17	0.01	0.16	208.	*	2	0055	300	0.0	0.0	0.0	16.
							*			SUM	24.17	2.68	21.49	

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
3913.	16.25	(CFS)	1708.	476.	459.	459.
		(INCHES)	19.367	21.590	21.594	21.594
		(AC-FT)	847.	944.	944.	944.

CUMULATIVE AREA = 0.82 SQ MI

HYDROGRAPH AT STATION A1
PLAN 1, RATIO = 0.50



PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
1957.	16.25	(CFS)	854.	238.	229.	229.
		(INCHES)	9.684	10.795	10.797	10.797
		(AC-FT)	423.	472.	472.	472.

CUMULATIVE AREA = 0.82 SQ MI

14 KK A2 ROUTE INFLOW HYDROGRAPH THROUGH DEER PARK POND

HYDROGRAPH ROUTING DATA

15 RS STORAGE ROUTING
NSTPS 1 NUMBER OF SUBREACHES
ITYP STOR TYPE OF INITIAL CONDITION
RSVRIC 356.00 INITIAL CONDITION
X 0.0 WORKING R AND D COEFFICIENT

16 SV	STORAGE	0.0	356.0	382.2	409.6	432.3	455.8	492.5	524.4	557.4	627.1
17 SE	ELEVATION	920.00	934.60	935.10	935.60	936.00	936.40	937.00	937.50	938.00	939.00
18 SQ	DISCHARGE	0.	0.	21.	59.	95.	114.	458.	1128.	2362.	4599.
19 SE	ELEVATION	920.00	934.60	935.10	935.60	936.00	936.40	937.00	937.50	938.00	939.00

20 SS SPILLWAY
CREL 934.60 SPILLWAY CREST ELEVATION
SPWID 19.50 SPILLWAY WIDTH
COQW 3.00 WEIR COEFFICIENT
EXPW 1.50 EXPONENT OF HEAD

21 ST TOP OF DAM
TOPEL 936.40 ELEVATION AT TOP OF DAM
DAMWID 390.50 DAM WIDTH
COQD 0.0 WEIR COEFFICIENT
EXPD 1.50 EXPONENT OF HEAD

***

COMPUTED STORAGE-OUTFLOW CURVE

STORAGE	0.0	356.00	382.20	409.60	432.30	455.80	492.50	524.40	557.40	627.10
OUTFLOW	0.0	0.0	20.70	58.50	95.10	114.00	458.00	1128.00	2362.00	4599.00

PLAN 1,

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0000	1	0.	356.0	934.6	1		0820	101	1.	357.7	934.6	1		1640	201	1617.	537.5	937.7
1		0005	2	0.	356.0	934.6	1		0825	102	2.	357.9	934.6	1		1645	202	1586.	536.6	937.7
1		0010	3	0.	356.0	934.6	1		0830	103	2.	358.2	934.6	1		1650	203	1535.	535.3	937.7
1		0015	4	0.	356.0	934.6	1		0835	104	2.	358.5	934.6	1		1655	204	1471.	533.6	937.6
1		0020	5	0.	356.0	934.6	1		0840	105	2.	358.9	934.7	1		1700	205	1403.	531.8	937.6
1		0025	6	0.	356.0	934.6	1		0845	106	3.	359.2	934.7	1		1705	206	1335.	529.9	937.6
1		0030	7	0.	356.0	934.6	1		0850	107	3.	359.5	934.7	1		1710	207	1268.	528.2	937.6
1		0035	8	0.	356.0	934.6	1		0855	108	3.	359.8	934.7	1		1715	208	1206.	526.5	937.5
1		0040	9	0.	356.0	934.6	1		0900	109	3.	360.2	934.7	1		1720	209	1147.	524.9	937.5
1		0045	10	0.	356.0	934.6	1		0905	110	4.	360.5	934.7	1		1725	210	1107.	523.4	937.5
1		0050	11	0.	356.0	934.6	1		0910	111	4.	360.8	934.7	1		1730	211	1075.	521.9	937.5
1		0055	12	0.	356.0	934.6	1		0915	112	4.	361.2	934.7	1		1735	212	1043.	520.3	937.4
1		0100	13	0.	356.0	934.6	1		0920	113	4.	361.5	934.7	1		1740	213	1010.	518.8	937.4
1		0105	14	0.	356.0	934.6	1		0925	114	5.	361.8	934.7	1		1745	214	978.	517.3	937.4
1		0110	15	0.	356.0	934.6	1		0930	115	5.	362.2	934.7	1		1750	215	946.	515.8	937.4
1		0115	16	0.	356.0	934.6	1		0935	116	5.	362.5	934.7	1		1755	216	916.	514.3	937.3
1		0120	17	0.	356.0	934.6	1		0940	117	5.	362.8	934.7	1		1800	217	866.	512.9	937.3
1		0125	18	0.	356.0	934.6	1		0945	118	6.	363.2	934.7	1		1805	218	858.	511.5	937.3
1		0130	19	0.	356.0	934.6	1		0950	119	6.	363.5	934.7	1		1810	219	831.	510.3	937.3
1		0135	20	0.	356.0	934.6	1		0955	120	6.	363.8	934.7	1		1815	220	804.	509.0	937.3
1		0140	21	0.	356.0	934.6	1		1000	121	6.	364.1	934.8	1		1820	221	778.	507.7	937.2
1		0145	22	0.	356.0	934.6	1		1005	122	7.	364.5	934.8	1		1825	222	752.	506.5	937.2
1		0150	23	0.	356.0	934.6	1		1010	123	7.	364.8	934.8	1		1830	223	724.	505.1	937.2
1		0155	24	0.	356.0	934.6	1		1015	124	7.	365.1	934.8	1		1835	224	694.	503.7	937.2
1		0200	25	0.	356.0	934.6	1		1020	125	7.	365.5	934.8	1		1840	225	661.	502.2	937.2
1		0205	26	0.	356.0	934.6	1		1025	126	8.	365.8	934.8	1		1845	226	626.	500.5	937.1
1		0210	27	0.	356.0	934.6	1		1030	127	8.	366.1	934.8	1		1850	227	590.	498.8	937.1
1		0215	28	0.	356.0	934.6	1		1035	128	8.	366.4	934.8	1		1855	228	552.	497.0	937.1
1		0220	29	0.	356.0	934.6	1		1040	129	8.	366.7	934.8	1		1900	229	513.	495.1	937.0
1		0225	30	0.	356.0	934.6	1		1045	130	9.	367.1	934.8	1		1905	230	474.	493.3	937.0
1		0230	31	0.	356.0	934.6	1		1050	131	9.	367.4	934.8	1		1910	231	442.	491.4	937.0
1		0235	32	0.	356.0	934.6	1		1055	132	9.	367.7	934.8	1		1915	232	430.	489.5	937.0
1		0240	33	0.	356.0	934.6	1		1100	133	9.	368.0	934.8	1		1920	233	411.	487.5	936.9
1		0245	34	0.	356.0	934.6	1		1105	134	10.	368.3	934.8	1		1925	234	393.	485.6	936.9
1		0250	35	0.	356.0	934.6	1		1110	135	10.	368.6	934.8	1		1930	235	375.	483.6	936.9
1		0255	36	0.	356.0	934.6	1		1115	136	10.	368.9	934.9	1		1935	236	357.	481.7	936.8
1		0300	37	0.	356.0	934.6	1		1120	137	10.	369.2	934.9	1		1940	237	339.	479.8	936.8
1		0305	38	0.	356.0	934.6	1		1125	138	11.	369.5	934.9	1		1945	238	322.	478.0	936.8
1		0310	39	0.	356.0	934.6	1		1130	139	11.	369.8	934.9	1		1950	239	305.	476.2	936.7
1		0315	40	0.	356.0	934.6	1		1135	140	11.	370.1	934.9	1		1955	240	289.	474.5	936.7
1		0320	41	0.	356.0	934.6	1		1140	141	11.	370.4	934.9	1		2000	241	274.	472.9	936.7
1		0325	42	0.	356.0	934.6	1		1145	142	12.	370.7	934.9	1		2005	242	260.	471.3	936.7
1		0330	43	0.	356.0	934.6	1		1150	143	12.	371.0	934.9	1		2010	243	246.	469.8	936.6
1		0335	44	0.	356.0	934.6	1		1155	144	12.	371.3	934.9	1		2015	244	232.	468.4	936.6
1		0340	45	0.	356.0	934.6	1		1200	145	12.	371.6	934.9	1		2020	245	220.	467.1	936.6
1		0345	46	0.	356.0	934.6	1		1205	146	13.	371.9	934.9	1		2025	246	208.	465.8	936.6
1		0350	47	0.	356.0	934.6	1		1210	147	13.	372.2	934.9	1		2030	247	197.	464.6	936.5
1		0355	48	0.	356.0	934.6	1		1215	148	13.	372.6	934.9	1		2035	248	186.	463.5	936.5
1		0400	49	0.	356.0	934.6	1		1220	149	13.	373.0	934.9	1		2040	249	176.	462.4	936.5
1		0405	50	0.	356.0	934.6	1		1225	150	14.	373.5	934.9	1		2045	250	166.	461.4	936.5
1		0410	51	0.	356.0	934.6	1		1230	151	14.	374.2	934.9	1		2050	251	157.	460.4	936.5
1		0415	52	0.	356.0	934.6	1		1235	152	15.	375.1	935.0	1		2055	252	149.	459.5	936.5
1		0420	53	0.	356.0	934.6	1		1240	153	16.	376.3	935.0	1		2100	253	141.	458.7	936.4
1		0425	54	0.	356.0	934.6	1		1245	154	17.	377.7	935.0	1		2105	254	133.	457.8	936.4
1		0430	55	0.	356.0	934.6	1		1250	155	18.	379.3	935.0	1		2110	255	126.	457.1	936.4
1		0435	56	0.	356.0	934.6	1		1255	156	20.	381.2	935.1	1		2115	256	119.	456.4	936.4
1		0440	57	0.	356.0	934.6	1		1300	157	22.	383.3	935.1	1		2120	257	114.	455.7	936.4
1		0445	58	0.	356.0	934.6	1		1305	158	25.	385.6	935.2	1		2125	258	113.	455.0	936.4
1		0450	59	0.	356.0	934.6	1		1310	159	29.	388.1	935.2	1		2130	259	113.	454.4	936.4
1		0455	60	0.	356.0	934.6	1		1315	160	32.	390.7	935.3	1		2135	260	112.	453.7	936.4
1		0500	61	0.	356.0	934.6	1		1320	161	36.	393.5	935.3	1		2140	261	112.	453.1	936.4
1		0505	62	0.	356.0	934.6	1		1325	162	40.	396.3	935.4	1		2145	262	111.	452.4	936.3
1		0510	63	0.	356.0	934.6	1		1330	163	44.	399.2	935.4	1		2150	263	111.	451.8	936.3
1		0515	64	0.	356.0	934.6	1		1335	164	48.	402.3	935.5	1		2155	264	110.	451.1	936.3
1		0520	65	0.	356.0	934.6	1		1340	165	53.	405.4	935.5	1		2200	265	110.	450.5	936.3
1		0525	66	0.	356.0	934.6	1		1345	166	57.	408.6	935.6	1		2205	266	109.	449.9	936.3
1		0530	67	0.	356.0	934.6	1		1350	167	62.	411.9	935.6	1		2210	267	109.	449.2	936.3
1		0535	68	0.	356.0	934.6	1		1355	168	66.	415.2	935.7	1		2215	268	108.	448.6	936.3
1		0540	69	0.	356.0	934.6	1		1400	169	73.	418.6	935.8	1		2220	269	108.	448.0	936.3
1		0545	70	0.	356.0	934.6	1		1405	170	79.	422.1	935.8	1		2225	270	107.	447.4	936.3

1	0550	71		0.	356.0	934.6	*	1	1410	171	84.	428.5	935.9	*	1	2230	271	107.	446.8	936.2
1	0555	72		0.	356.0	934.6	*	1	1415	172	90.	429.0	935.9	*	1	2235	272	106.	446.1	936.2
1	0600	73		0.	356.0	934.6	*	1	1420	173	95.	432.5	936.0	*	1	2240	273	106.	445.5	936.2
1	0605	74		0.	356.0	934.6	*	1	1425	174	98.	436.1	936.1	*	1	2245	274	105.	444.9	936.2
1	0610	75		0.	356.0	934.6	*	1	1430	175	101.	439.8	936.1	*	1	2250	275	105.	444.3	936.2
1	0615	76		0.	356.0	934.6	*	1	1435	176	104.	443.5	936.2	*	1	2255	276	104.	443.7	936.2
1	0620	77		0.	356.0	934.6	*	1	1440	177	107.	447.3	936.3	*	1	2300	277	104.	443.1	936.2
1	0625	78		0.	356.0	934.6	*	1	1445	178	110.	451.2	936.3	*	1	2305	278	103.	442.5	936.2
1	0630	79		0.	356.0	934.6	*	1	1450	179	114.	455.2	936.4	*	1	2310	279	103.	442.0	936.2
1	0635	80		0.	356.0	934.6	*	1	1455	180	145.	459.2	936.5	*	1	2315	280	102.	441.4	936.2
1	0640	81		0.	356.0	934.6	*	1	1500	181	181.	463.0	936.5	*	1	2320	281	102.	440.8	936.1
1	0645	82		0.	356.0	934.6	*	1	1505	182	216.	466.7	936.6	*	1	2325	282	101.	440.2	936.1
1	0650	83		0.	356.0	934.6	*	1	1510	183	249.	470.2	936.6	*	1	2330	283	101.	439.6	936.1
1	0655	84		0.	356.0	934.6	*	1	1515	184	280.	473.5	936.7	*	1	2335	284	101.	439.1	936.1
1	0700	85		0.	356.0	934.6	*	1	1520	185	310.	476.7	936.7	*	1	2340	285	100.	438.5	936.1
1	0705	86		0.	356.0	934.6	*	1	1525	186	340.	479.9	936.8	*	1	2345	286	100.	437.9	936.1
1	0710	87		0.	356.0	934.6	*	1	1530	187	369.	483.0	936.8	*	1	2350	287	99.	437.4	936.1
1	0715	88		0.	356.0	934.6	*	1	1535	188	399.	486.2	936.9	*	1	2355	288	99.	436.8	936.1
1	0720	89		0.	356.0	934.6	*	1	1540	189	433.	489.9	937.0	*	2	0000	289	98.	436.2	936.1
1	0725	90		0.	356.0	934.6	*	1	1545	190	491.	494.1	937.0	*	2	0005	290	98.	435.7	936.1
1	0730	91		0.	356.1	934.6	*	1	1550	191	590.	498.8	937.1	*	2	0010	291	97.	435.1	936.0
1	0735	92		0.	356.1	934.6	*	1	1555	192	701.	504.1	937.2	*	2	0015	292	97.	434.6	936.0
1	0740	93		0.	356.2	934.6	*	1	1600	193	822.	509.9	937.3	*	2	0020	293	96.	434.0	936.0
1	0745	94		0.	356.2	934.6	*	1	1605	194	949.	515.9	937.4	*	2	0025	294	96.	433.5	936.0
1	0750	95		0.	356.4	934.6	*	1	1610	195	1075.	521.9	937.5	*	2	0030	295	96.	432.9	936.0
1	0755	96		0.	356.5	934.6	*	1	1615	196	1235.	527.3	937.5	*	2	0035	296	95.	432.3	936.0
1	0800	97		1.	356.7	934.6	*	1	1620	197	1397.	531.6	937.6	*	2	0040	297	94.	431.8	936.0
1	0805	98		1.	356.9	934.6	*	1	1625	198	1514.	534.7	937.7	*	2	0045	298	93.	431.2	936.0
1	0810	99		1.	357.1	934.6	*	1	1630	199	1586.	536.6	937.7	*	2	0050	299	92.	430.6	936.0
1	0815	100		1.	357.4	934.6	*	1	1635	200	1618.	537.5	937.7	*	2	0055	300	91.	430.0	936.0

****

EAK OUTFLOW IS 1618. AT TIME 16.58 HOURS

PEAK FLOW (CFS)	TIME (HR)		6-HR	MAXIMUM AVERAGE FLOW 24-HR	72-HR	24.92-HR
1618.	16.58	(CFS)	698.	200.	192.	192.
		(INCHES)	7.918	9.054	9.054	9.054
		(AC-FT)	346.	396.	396.	396.

EAK STORAGE (AC-FT)	TIME (HR)	6-HR	MAXIMUM AVERAGE STORAGE 24-HR	72-HR	24.92-HR
536.	16.58	498.	413.	411.	411.

PEAK STAGE (FEET)	TIME (HR)	6-HR	MAXIMUM AVERAGE STAGE 24-HR	72-HR	24.92-HR
937.70	16.58	936.94	935.59	935.56	935.56

CUMULATIVE AREA = 0.82 SQ MI

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO FLOWS RATIO 1 0.10	 RATIO 2 0.25	 RATIO 3 0.50
HYDROGRAPH AT	A1	0.82	1	FLOW	391.	978.	1957.
				TIME	16.25	16.25	16.25
ROUTED TO	A2	0.82	1	FLOW	83.	448.	1618.
				TIME	18.67	17.42	16.58
			** PEAK STAGES IN FEET **				
			1	STAGE	935.87	936.98	937.70
				TIME	18.67	17.42	16.58

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION A2

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	934.60	934.60	936.40
STORAGE	356.	356.	466.
OUTFLOW	0.	0.	114.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.10	935.87	0.0	425.	83.	0.0	18.67	0.0
0.25	936.98	0.58	491.	448.	4.42	17.42	0.0
0.50	937.70	1.30	538.	1613.	6.42	16.58	0.0

*** NORMAL END OF JOB ***

APPENDIX 5

REFERENCES

DEER PARK POND DAM

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